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INGELSTRÖM (E.). **Trips på gladiolus.** [Thrips on Gladiolus.]—*Växtskyddsnotiser* 1949 no. 6 pp. 15–16. Stockholm, 1949.

Deformation and injury to the leaves of *Gladiolus* in Sweden, which had been observed for several years, were found in 1949 to be due to *Taeniothrips simplex* (Morison), a thrips not previously recorded from that country. The possibilities of control are briefly discussed.

SYLVÉN (E.). **Ett bekämpningsförsök mot skidgallmyggan.** [An Experiment on the Control of *Dasyneura brassicae*.]—*Växtskyddsnotiser* 1950 no. 2 pp. 23–26, 1 fig. Stockholm, 1950.

In a further test on the control of *Dasyneura brassicae* (Winn.) on rape in Sweden [*cf. R.A.E.*, A **40** 54–55], spring rape was dusted during the flowering period in late June 1949 at about 15·3 lb. per acre with a DDT powder and a powder containing 2 per cent. methyl-parathion. The DDT did not reduce the numbers of adults of *D. brassicae* or the rape weevil [*Ceuthorrhynchus assimilis* (Payk.)] taken by sweeping, and did not significantly reduce the injury to the pods, but the methyl-parathion reduced the numbers of the weevil and kept them low for a considerable time, and though there was no marked effect on the numbers of adults of *D. brassicae*, infestation of the pods by it was reduced by 76 per cent. This result is thought to have been largely due to control of the weevil [*cf. loc. cit.*].

SYLVÉN (E.). **Blodlusarbetet i spärrzonen.** [Work against *Eriosoma lanigerum* in the Buffer Zone.]—*Växtskyddsnotiser* 1951 no. 1 pp. 7–12, 1 fig., 1 map. Stockholm, 1951.

Further surveys of apple in 1949–50 in the buffer zone established to prevent the spread of *Eriosoma lanigerum* (Hsm.) in Sweden [*cf. R.A.E.*, A **39** 130] showed that infestation was somewhat heavier than had previously been thought. The Aphid was found on 103 trees in 24 gardens between May 1949 and April 1950 and on 53 in 14 gardens during the rest of 1950. Control measures were continued as before [*cf. loc. cit.*], and it was thought that eradication had been achieved on many properties by the end of the period.

FJELDDALEN (J.). **E 605–Parathion.** [*In Norwegian.*]—*Gartneryrket* 1950 no. 30 repr. [3] pp., 1 fig. Oslo, 1950. (With a Summary in English.)

The results are given of laboratory tests in which E 605 (a German preparation consisting of 30 per cent. of a mixture of parathion and methyl-parathion and 70 per cent. emulsifiers [*cf. R.A.E.*, A **40** 45, note]), E 605 M (a German preparation consisting of 30 per cent. methyl-parathion and 70 per cent. emulsifiers) and a wettable powder containing 15 per cent. parathion were compared for their toxicity to various insects. Series of sprays containing equal proportions of active ingredients by weight were prepared and applied to the insects themselves or to leaves of their food-plants to which they were subsequently transferred. The results are given in a table. E 605, E 605 M and wettable parathion caused 77·8, 69·9 and 63·3 per cent. mortality, respectively, of *Macrosiphum pisum* (Harris) (*pisi* (Kalt.)) after 48 hours at 0·005 per cent. active ingredient, 86·6, 66·6 and 83·3 per cent. mortality of *M. solanifolii* (Ashm.) after 48 hours at 0·01 per cent., 70, 13·3 and 75·7 per cent. mortality of *M. rosae* (L.) after 24 hours at 0·01 per cent., 79·9, 77·1 and 83·3 per cent. mortality of *Brevicoryne brassicae* (L.) after 24 hours at 0·02 per cent., and 50, 46·3 and 36·6 per cent. mortality of adults and 71, 19·8 and 95·5 per cent. mortality of larvae of *Epilachna varivestis* Muls. after 72 hours at 0·02 per cent.

UVAROV (B. P.) & others. **Observations on the Moroccan Locust** (*Dociostaurus maroccanus* **Thunberg**) **in Cyprus, 1950.**—*Anti-Locust Bull.* no. 10, [4+] 52 pp., 5 pls., 2 figs., 19 refs. London, 1951.

This bulletin contains four papers. In **Cyprus Locust Research Scheme** (pp. 1–2), B. P. UVAROV gives a brief introductory account of the initiation of research on *Dociostaurus maroccanus* (Thnb.) and its control by ecological methods in Cyprus and the appointment of a temporary research team, the three members of which are responsible for the remaining papers. **Vegetation of Locust Habitats,** by E. CHAPMAN (pp. 2–18), contains an account of a preliminary investigation in 1950 of the composition of the vegetation and the amount of cover provided by it in the infested areas.

In **Observations on Locust Hoppers** (pp. 18–36), N. WALOFF describes field observations carried out between 23rd March and 22nd April 1950. The lowlands separating the Kyrenia hills in the north of the island from the Troödos mountains in the south-west are intensely cultivated, but broken up by wastelands and fallows ; the former are on flat, limestone outcrops and provide areas of firm, undisturbed soil, short vegetation and numerous bare patches, which are eminently suitable for locusts, and there are also large populations on old fallows with well settled soil and bare patches. *Dociostaurus* also occurs in the foothills to the south of the northern range, where it is largely confined to the flatter ledges with sparsely growing annual grasses, but it was on the whole absent from the northern foothills, which are composed of soft, shelly clays. At altitudes above 1,000 ft., the mountain ranges are covered with scrub or forest, and no locusts were observed above 1,250 ft., though they occur at greater heights in Anatolia [*cf. R.A.E.*, A **20** 548]. The seven types of habitat described in the second paper are briefly reviewed, and the relation between hopper density and the percentages of bare ground, stone, dead vegetation and lichen or moss and the height of the vegetation in examples of each are shown in tables. Hatching was first observed on the plain on 27th March, but may have begun a little earlier locally, and continued until 12th April. Adults were first seen on the plain on 22nd April, though they were present in a warm, sheltered area with as much as 50 per cent. limestone outcrop near Famagusta on 19th. Various methods of estimating the density of the hoppers were tested and are described. Those adopted for solitary hoppers were the use of foot-square wire-frames, which were laid down in groups of 100 and were successful for populations of low and medium densities, sweeping, which was of value for rapid surveys, and the recovery of marked specimens, which was suitable only for hoppers that had reached the fourth instar. Gregarious hoppers were seen on only two occasions ; two methods of estimating their density were tested and gave similar results. One was based on the number of groups in an area, the average size of the groups, and the average number of hoppers per sq. in., while scattered hoppers were killed and counted under a net of known area. Short descriptions of hoppers in each of the five instars from populations of high and low densities are given. Three basic colour patterns were noted. The proportions of each varied for different habitats and densities, and it is possible that they are phase characters. Hoppers in cages changed from one pattern to another. The distribution of the hoppers within habitats was uneven and frequently related to the height of the vegetation, varying with the growth of annual plants. The hoppers remained on or near the ground during the day, moving to the top of the plants at night. During periods of overcast skies and wind, gregarious nymphs tended to form compact groups, mostly in sheltered places.

In **Observations on Adult Locusts** (pp. 36–51), A. R. WATERSTON records observations made during 1948–50. Large populations of adults occurred in the uncultivable areas of the plains at altitudes of 0–700 ft. and low ones

(phase *solitaria*) in the foothills on either side of the plain at 600–1,000 ft. Colonies were found in the plain south of the Troödos mountains, but were rare to the north of the Kyrenia range, where the slope is steep, and the perennial plant cover denser, the annual rainfall higher (20–24 ins.) and the air more humid than in the southern foothills. Breeding sites were characterised by sparse, low vegetation, compact soil from sedimentary rocks, with bare places, and annual rainfall of 12–20 ins. The lowest densities occurred in a narrow climatic zone with rainfall of 16–20 ins. Although in general adults were present about the third week in April, they did not appear on the coast in the Kyrenia district until 30th April. The fifth-instar hoppers moulted in taller and denser vegetation than that preferred by the younger ones. Fledgling adults spent the day wandering and basking among the more open vegetation, especially on tracks, and roosted at night in patches of taller vegetation at a height of 3–12 ins. above the ground. They were readily disturbed during the day, and then jumped or flew several feet. Males predominated over females and were the more active. Pairing took place about ten days after the final moult. Data obtained from recoveries following mass releases of marked adults in May indicated a tendency to move across the ground presenting the least resistance. The three colour classes found among the hoppers were also observed among adults and, with the colour changes associated with maturity, are described. The rate of maturation appeared to vary in different habitats. Oviposition began about the middle of May. The ovipositing females made many holes without laying eggs in them, chiefly owing to disturbance by males or the passage of flocks. In general, oviposition sites were characterised by the presence of vegetation little more than 1 inch in height and patches of firm bare compact soil. The numbers of eggs per pod in 18 pods examined varied from 22 to 35 and averaged 29. The oviducts of females that had oviposited were empty. Adults were present in the field for total periods of 63–70 days and appeared to have died out by 26th June ; under cage conditions, they survived for up to 114 days.

Three Bombyliids, *Systoechus autumnalis* (Pall.), *Thyridanthrax perspicillaris* (Lw.), and *Thyridanthrax* sp., and the Clerid, *Trichodes laminatus* var. *cyprius* Rttr., have repeatedly been bred from egg-pods of *D. maroccanus* in Cyprus, and adults of all were plentiful in breeding grounds in the plain where female locusts were ovipositing ; the Bombyliids were widely distributed at altitudes up to 700 ft., but *Trichodes* was not found in the very low populations on the north coast or in the south-west. None appeared to be attracted by ovipositing locusts. In both 1949 and 1950, adults of *Trichodes* appeared just after the fledgling locusts and as *Teucrium polium* began to flower. Adults of all four species were attracted by the flowers of this plant, which probably detain them on the breeding sites until the locusts oviposit. Locust adults and last-instar hoppers were often found infested by mites, which occurred on the veins of the wings and the intersegmental membranes of the abdomen, but did not appear to affect their hosts when present in small numbers. Some last-instar hoppers found long after most of the populations had become adult and some fledgling locusts with crumpled elytra and wings were heavily parasitised by mites, however. Dead and dying locusts showing exit holes made by Dipterous larvae were found in May. In low populations, 3–14 per cent. of the adults were affected, and 8 per cent. of the females from very low populations that were dissected were parasitised. Dipterous larvae found in them during the first week of May readily pupated in soil, so that attack may occur when the hoppers are in the fourth or fifth instars. Evidence was obtained that parasitised locusts may deposit some eggs. No signs of parasitism were observed after 19th May. Adults reared from Dipterous larvae dissected from locusts were identified as *Acemya acuticornis* (Mg.) and *Sarcophaga* (*Blaesoxipha*) *filipjevi* (Rohd.).

FRANZ (J. M.). **Observations on collecting Parasites of *Cacoecia histrionana* (Froel.) (Lep., Tortricidae).**—*Bull. ent. Res.* **43** pt. 1 pp. 1–19, 3 pls., 2 figs., 17 refs. London, 1952.

Tortrix (*Cacoecia*) *histrionana* Froel. occurs in Europe in all natural and many cultivated spruce forests between the Carpathian mountains and southern France, but no outbreaks have been reported. In view of the possibility that this Tortricid is controlled by parasites that could be introduced into Canada for use against the spruce budworm, *Choristoneura fumiferana* (Clem.), studies of it and its parasites were made during 1946–49. The following is partly based on the author's summary of work in Germany in 1948–49. *T. histrionana* was found in several localities on the north-eastern frontier of Bavaria, but was nowhere abundant. The larvae are commonest along the edges of spruce woods 20–50 years of age. The eggs are laid on the needles, and the larvae hatch after about two weeks and feed on the needles within webs until the onset of cold weather. They do not diapause, and resume feeding in spring, when young shoots are preferred. There are ten larval instars. Pupation takes place within webs at the site of feeding or in more sheltered parts of the crown of the tree, and the adults emerge after 2–3 weeks, generally in July-August. There is usually one generation a year. Larvae in many stages of development are present together, and this is attributed chiefly to the absence of diapause. The lower temperature limit for the movement and feeding of larvae ready for overwintering was about 4°C. [39·2°F.].

From a total of 1,738 larvae and 65 pupae collected in the field in three separate periods in 1949, 16 primary parasites and four hyperparasites were reared, comprising 12 Ichneumonids, four Braconids, two Eulophids, and a Pteromalid that acted as both a primary and a secondary parasite. A list of these is given. From the combined results, the minimum reduction of the host population after overwintering was calculated as being 66·8 per cent., and the parasitism of the pupae as at least 13·5 per cent. Egg parasitism also occurred. Nine of the 20 parasites known from *T. histrionana* were bred from other insects in the same community. The most important larval parasite was the Braconid, *Meteorus ruficeps* (Nees), which completed two or three generations to one of *T. histrionana*. A proportion of the population also overwinters in other Microlepidoptera, and *T. histrionana* is attacked chiefly in summer. Complete development lasted scarcely four weeks in summer in the older host larvae but was prolonged in the cooler seasons and in young larvae. Pupation takes place in a cocoon within the web of the host, which survives for a few days after the parasite has left it. The adult parasites readily feed on sugar solution and survive for weeks at low temperatures. Females were slightly more numerous than males among examples reared in the laboratory. Host larvae are attacked in all instars except the first, but those that are three-quarters grown are preferred. In the field, parasite adults began to emerge during the last week of May and were present until October, with a peak in July. Cocoons were despatched to Canada.

A few larvae of *T. histrionana* that had probably died from disease were occasionally found, but disease was of little consequence as a mortality factor in 1949. It is concluded that parasitism is important in affecting changes in the population density of *T. histrionana*.

HEWLETT (P. S.). **Piperonyl Butoxide as a Constituent of heavy-oil Sprays for the Control of Stored Product Insects. II. The Effect of Piperonyl Butoxide on the Toxicities of Allethrin, DDT, and BHC, and on the joint Toxicity of BHC and Pyrethrins, to *Tribolium castaneum*.**—*Bull. ent. Res.* **43** pt. 1 pp. 21–32, 13 refs. London, 1952.

An account is given of further experiments on the effect of technical piperonyl butoxide (PB) on the toxicity of insecticides in Shell oil P31, in which adults

of *Tribolium castaneum* (Hbst.) were exposed to direct sprays or to films deposited by them [*cf. R.A.E.*, A **40** 1] and the insecticides included allethrin (completely synthetic allyl homologue of cinerin I, about 90 per cent. pure), BHC (pure γ benzene hexachloride) and DDT (pure p,p′-isomer). The effectiveness of direct sprays containing 3·5 per cent. allethrin and of the films deposited by them and of direct sprays containing 1·5 per cent. BHC was markedly improved by the addition of 5 per cent. PB when the same amounts of total insecticide were applied, but that of films deposited by sprays containing 0·05, 0·1 and 0·2 per cent. BHC was only slightly, though significantly, improved by the inclusion of 2·5 per cent. PB. The toxicity of direct sprays containing 2 per cent. DDT was unchanged by the addition of 5 per cent. PB and that of films deposited by sprays containing 0·6 per cent. DDT was reduced by the addition of 10 per cent. PB.

The effect of the addition of 2·5 per cent. PB on the joint toxicity of direct sprays containing 0·3 per cent. BHC with 0·37 per cent. pyrethrins was also investigated. The data were not conclusive, but indicated strongly that in a mixture containing all three materials, PB synergised each insecticide as though the other were absent.

These results and those of the earlier experiments with pyrethrins [*loc. cit.*] are discussed with reference to the results of work already noticed on the action of pyrethrins, BHC and DDT applied in pairs [**39** 52]. It seems probable that the relative toxicities of combinations of pyrethrins, DDT, BHC and PB in pairs having a common member are the same when they are applied directly as when they are applied as films, and that pairs of these materials are more toxic as direct sprays than as films. It is also probable, for both sprays and films, that combinations of pyrethrins with PB or with BHC are equal in toxicity and superior to pyrethrins with DDT, that PB with BHC is inferior to PB with pyrethrins and superior to PB with DDT, and that DDT with pyrethrins or with BHC is superior to DDT with PB.

SELLERS (W. F.). **The Collection of the Cactus Weevil, *Cactophagus spinolae* (Gylh.), in Mexico and its Dispatch to South Africa.**—*Bull. ent. Res.* **43** pt. 1 pp. 43–50, 3 figs. London, 1952.

Nearly 18,000 adults of *Cactophagus spinolae* (Gylh.) were collected in Mexico in 1946–48 and dispatched to South Africa for use in the biological control of *Opuntia* (*Platyopuntia*) *megacantha* and *O.* (*P.*) *aurantiaca*. They were sent by air in specially designed containers, which are described, and arrived in excellent condition. The distribution and habits of *C. spinolae* are reviewed, largely from the literature relating to the introduction of insects for the control of *Opuntia* in Australia. In Mexico, it has one generation a year. The larvae tunnel in the segments and stems of species of the subgenus *Platyopuntia*, and frequently destroy the whole plant. Pupation takes place within the stem. The adults survive for periods varying from several months to over a year ; they feed on the tender shoots, fruits and pads, and can live for several weeks without food. Where prickly pears are cultivated as a crop, hand-collection of the adults is practised as a control measure. It was decided not to liberate *C. spinolae* in Australia, because in feeding tests, the adults fed on the fruits of pumpkin and banana and the stems of maize, and the larvae on tomato and *Papaya* stems and banana fruits, though the tests showed that the species was unlikely to persist on plants other than prickly pear and *Cereus*. There are three other species of *Cactophagus* that attack species of *Platyopuntia*, *Nopalea* and *Cereus* in Mexico or Central America. *C. validus* (Lec.) is a west-coast species common in the State of Sinaloa, where it is very injurious to prickly pear of the shrub type ; it has been recorded as far north as Arizona and California. *C. fåhraei* (Gylh.) and *C. striatoforatus*

(Gylh.) are destructive to prickly pear of the tree type and to *Cereus*, the former in southern Mexico and the latter in Salvador and Guatemala ; *C. striatoforatus* has also been recorded from Trinidad.

JONES (G. D. G.) & EDWARDS (R. A.). **Studies of Toxicity of 3 : 5 Dinitro-ortho-cresol and its Sodium Salt to the Honey Bee.**—*Bull. ent. Res.* **43** pt. 1 pp. 67–78, 2 figs., 15 refs. London, 1952.

The following is based on the authors' summary. Laboratory and field experiments were carried out in Britain to study the toxicity of 3,5-dinitro-o-cresol (numbered with CH_3 as 1) (DNC) and its sodium salt to honey bees. In laboratory tests, the acid DNC was shown to be a rapidly acting contact poison under a wide variety of conditions, and its toxicity was not greatly affected by differences in temperature or humidity during or after treatment. Although the acid and the salt were equally toxic as stomach poisons, considerable differences were observed between the two substances as aqueous sprays and dry films. The toxicity of the sodium salt as an aqueous spray increased with the humidity of the environment after spraying. The salt was apparently non-toxic as a dry film, and increasing the humidity of the environment had no effect until the saturation point was reached, when it went into solution. At this point, the salt was almost as rapid in action as the acid. The salt was more toxic when deposited on a non-absorbent surface than on an absorbent one. Experiments on the penetration of the two substances through bees-wax showed that whereas the acid penetrated bees-wax in all forms tested, the salt penetrated only in aqueous solution.

The effect of the acid DNC on a population of foraging bees when used as a herbicide to control charlock (*Sinapis arvensis*) in a 20-acre field of spring oats was investigated. The numbers of foraging bees were reduced, but no appreciable damage was inflicted on the colony. It is considered that at temperatures at which active foraging on charlock takes place, spraying with DNC will be followed by a rapid wilting of the flowers and that this will render them unattractive as sources of nectar or pollen.

LE PELLEY (R.). **Note on Damage to Grazing by Grasshoppers in Kenya.**—*Bull. ent. Res.* **43** pt. 1 pp. 79–81. London, 1952.

Grasshoppers became sufficiently abundant to cause serious damage to grassland used for grazing over a limited area near Lake Elmenteita in the Rift Valley, Kenya, in July 1950. The two most injurious were *Gastrimargus brevipes* Sj. and *Caloptenopsis glaucopsis meruensis* Sj., but 14 other species, a list of which is given, were also present. A bait of benzene hexachloride in bran was applied, with good results, and by December the grasshoppers were very scarce. The distribution of rainfall was unusual in 1950, when considerable falls alternated with very dry periods, and this may have been a factor contributing to the increase. Grass over a wide area in the valley was also damaged by leaf-eating Coleoptera, notably *Epilachna hirta* (Thnb.), which were unusually abundant in May–June.

MILES (M.). **Studies of British Anthomyiid Flies.**—*Bull. ent. Res.* **43** pt. 1 pp. 83–90, 1 pl., 3 figs., 12 refs. London, 1952.

In this further part of a paper on British Anthomyiids [*cf. R.A.E.*, A **38** 475], the author gives characters by which all the immature stages of *Hylemyia* (*Delia*) *cilicrura* (Rond.), *H.* (*D.*) *trichodactyla* (Rond.), *H.* (*Erioischia*) *brassicae* (Bch.), *H.* (*E.*) *floralis* (Fall.) and *H.* (*Pegohylemyia*) *fugax* (Mg.) can be differentiated, except that the eggs of the first two cannot be distinguished

from each other. These species have hitherto been difficult to separate except in the adult stage. All five are associated with injury to cruciferous crops, but *H. cilicrura* and *H. trichodactyla* [*cf.* **36** 173] are primarily scavengers on plant and animal matter in the soil and *H. fugax* is associated with decaying vegetation [*cf.* **38** 476].

CHEU (S. P.). **Changes in the Fat and Protein Content of the African Migratory Locust,** *Locusta migratoria migratorioides* (**R. & F.**).—*Bull. ent. Res.* **43** pt. 1 pp. 101–109, 1 graph, 9 refs. London, 1952.

The following is substantially the author's summary of this account of laboratory investigations on adults of both sexes of *Locusta migratoria migratorioides* (R. & F.) in phases *gregaria* and *solitaria*. The process of build-up of reserve substances in *L. m. migratorioides* is very closely correlated with the feeding activity of the insect. Locusts attain their maximum body weight in the initial period before maturation. In the females, there is one minor build-up after each egg-pod is laid. As measured by the weight of excreta produced up to the deposition of the sixth egg-pod, the *gregaria* female consumes more food than the *solitaria*, but it has a lower rate of increase in body weight, maturation and oviposition. Locusts start to accumulate fat soon after the final ecdysis. The fat content reaches its maximum in the early part of adult life, and then declines in both sexes of both phases. By far the greater part of the fat reserve thus accumulated in the *gregaria* female is used up before oviposition, and only a small amount goes to the making of the first egg-pod. The fat of the subsequent egg-pods in the two phases is derived from the fat accumulated after each new egg-pod is laid. The *solitaria* females mature their eggs at various stages in the development of the fat-body. Those with a longer pre-maturation period have a higher fat content. Immature *gregaria* females have significantly more fat than those of *solitaria*, almost twice as much at the maximum, but this difference disappears completely before the first egg-pod is laid. It is suggested that this extra use of fat by *gregaria* is connected with a higher rate of metabolism as compared with *solitaria*. Data from one *solitaria* female suggested, further, that a lower rate of metabolism in this phase enables fat reserves to be kept at a higher level throughout the egg-laying period.

The protein content of a female locust reaches its height just before oviposition. The protein lost during the laying of each egg-pod is rapidly replaced by feeding. There is no difference in the percentage of protein between *gregaria* and *solitaria* females, although the latter have more protein by weight owing to their larger size. A mature locust has a significantly higher percentage of protein per fat-free dry body weight than an immature one. This is probably partly due to the deposition of protein in the cuticle as it thickens.

The egg-pods produced by the *solitaria* female were found to contain more eggs of smaller size than those of the *gregaria*. The difference in weight between the egg-pods of the two is, however, not statistically significant. High fecundity does not mean more egg material. No definite relation was found between fecundity, rate of maturation or oviposition, and fat and protein content.

It is suggested that the earlier maturation and higher rate of oviposition of the *solitaria* female are due to its more rapid build-up in body weight, which may be facilitated by lower metabolic activity.

HOWE (R. W.). **Entomological Problems of Food Storage in northern Nigeria.**—*Bull. ent. Res.* **43** pt. 1 pp. 111–144, 10 graphs, 8 refs. London, 1952.

A general investigation of the problems relating to the storage of export produce in Nigeria was made during 1948–50 [*cf.* also next abstract], and this paper comprises an account of entomological work connected primarily with

stored groundnuts at Kano, in northern Nigeria. The production of groundnuts has increased considerably during the past ten years, but transport facilities have not shown a comparable increase, and crops have consequently remained in store for long periods, occasionally for as long as 18 months, and the warehouses have been in continuous use for some five years. The groundnuts are shelled and stored in sacks, and since warehouse accommodation is inadequate, a method of stacking the sacks in pyramids in the open, which is described, was devised and has proved very successful ; they are protected from rain by rick sheets. Investigations on temperature and humidity showed that both are relatively equable in the warehouses, where, combined with the dim light, they provide conditions favouring insect development. Both show large and violent changes at the surface of the pyramids, however, which render the latter unsuitable as breeding sites ; the internal temperatures of the pyramids are too high for any insects except *Trogoderma granarium* Everts.

A list is given of the insects found associated with stored products at Kano, and the factors influencing their importance are briefly discussed. The major pests of stored groundnuts were *Tribolium castaneum* (Hbst.), *Trogoderma granarium*, *Ephestia cautella* (Wlk.) and *Plodia interpunctella* (Hb.). Other insects associated with them locally were *Alphitobius laevigatus* (F.), *Palorus ratzeburgi* (Wissm.), *Pachymerus* (*Caryedon*) *fuscus* (Goeze), *Laemophloeus ferrugineus* (Steph.), *Oryzaephilus surinamensis* var. *mercator* Fauv., *Mesostenopa picea* Kraatz, *Thorictodes heydeni* (Rttr.), *Corcyra cephalonica* (Staint.), *Aphanus sordidus* (F.) [*cf. R.A.E.*, A **35** 216], *Lyctocoris campestris* (F.) and *Thermobia* sp., and *Tribolium confusum* Duv., *T. anaphe* Hinton, *Anthicus floralis* (L.), *Phradonoma tricolor* (Arrow), *Attagenus gloriosae* (F.) and *Tenebroides mauritanicus* (L.) were widespread in small numbers. Termites caused some damage by eating the sacking, thus permitting the groundnuts to spill. *Calandra oryzae* (L.), *Rhizopertha dominica* (F.) and *Sitotroga cerealella* (Ol.) were found to be the major pests of stored sorghum (guinea corn), and *Dermestes maculatus* Deg. of hides.

Trogoderma granarium was first observed in Nigeria in 1948, on stored sorghum ; it was subsequently found to be extremely abundant and widespread on stored groundnuts, and evidence was obtained indicating that it had been present on them in 1946 and probably in 1944. Although the adults cannot fly, this Dermestid has spread rapidly, and it is concluded that it is an endemic species that has been enabled to build up rapidly by reason of the prolonged periods of storage in recent years. In 1949, groundnuts frequently became infested during storage in warehouses that had contained infested stocks one or two seasons before, even though they had meanwhile remained empty for six months. The larvae crawl to neighbouring storage sites, and both adults and larvae can be dispersed by wind. The larvae feed on the groundnuts, powdering more than they consume, and also cause typical weakening of the sacks, which ultimately tear. There is some risk that this Dermestid may be introduced into the ports in the south with untreated groundnuts, but it is unlikely to become of importance there owing to the less favourable climatic conditions, competition with *Tribolium*, and attack by a predacious Anthocorid, tentatively determined as *Lyctocoris* sp.

Observations on the loss of weight of groundnuts due to insect attack showed that losses were in general greater in warehouses than in pyramids, in the outer sacks of pyramids than in the inner, and where *Trogoderma* was present than where it was not. The average loss in weight of groundnuts due to insect infestation was estimated at about 4·5 per cent., but this is masked in practice, since much frass remains in the sacks and there is an increase in weight due to the uptake of moisture during storage inland, transit to the ports and storage there. The moisture uptake is not uniform throughout the stacks, since the high temperatures at the centre cause drying there with a consequent

increase in moisture at the base. Some 0·25 per cent. of the groundnuts at the base are damaged so severely by water that they have to be discarded. The dust produced in the sacks by insect infestation is deficient in oil, but oil losses during storage are nevertheless negligible. The quality of the oil (measured as increased content of free fatty acids) shows definite deterioration during storage, especially in groundnut fragments, and this deterioration is increased both by insect attack and high moisture content. The presence of large amounts of powder among stored groundnuts impairs the colour, flavour and keeping quality of the refined oil prepared from them.

COTTERELL (G. S.). **The Insects associated with Export Produce in southern Nigeria.**—*Bull. ent. Res.* **43** pt. 1 pp. 145–152, 6 refs. London, 1952.

The food commodities stored in southern Nigeria for export chiefly comprise cacao beans and kernels of the oil palm [*Elaeis guineënsis*], both of which are produced locally, and groundnuts, which are produced in the north [*cf.* preceding abstract] and stored in the south while awaiting shipment. At the ports, groundnuts become infested by insects native to the south, such as *Necrobia rufipes* (Deg.) and *Ahasverus advena* (Waltl), and pests of stored groundnuts such as *Tribolium castaneum* (Hbst.) and, to a less extent, *Plodia interpunctella* (Hb.) and *Corcyra cephalonica* (Staint.) spread to cacao beans and palm kernels. The two moths are distributed chiefly by means of the sacks in which groundnuts have been carried to the ports and stored prior to loading, which are subsequently used for other products. A small plant for the fumigation of used sacks is now in operation at one port. A list of the insects that infest stored products for export and local use is included, showing the commodities attacked by each.

Ephestia cautella (Wlk.) and *Lasioderma serricorne* (F.) are the major pests of stored cacao, and both spread from private storage premises, which are rarely cleaned and in which small amounts of low-grade beans are frequently retained. *E. cautella* also infests palm kernels, and the early abundance of adults in inland cacao stores during the marketing season is thought to be largely due to the storage of kernels in the vicinity. The larvae complete their development on the outside of whole beans and penetrate only those that have germinated or been damaged. They are parasitised by *Bracon hebetor* Say, which, however, is ineffective except where infestation is heavy. Infestation of cacao beans by *L. serricorne* is not of primary importance outside Nigeria, where it was first recorded in 1930 and has since steadily increased in severity. Attack becomes serious if storage is prolonged, and beans that are thoroughly dry are as readily attacked as others. The larvae feed on the cotyledons and pupate within the bean. This Anobiid is also a serious pest of local and imported tobacco in store in southern Nigeria. *Araecerus fasciculatus* (Deg.) has decreased in importance as a pest of stored cacao as a result of increased attention to the thorough drying of the beans [*cf. R.A.E.*, A **22** 618]. Insect infestation affects the quality of the cacao beans, without materially reducing their weight. The risk of living insects being conveyed to manufacturing premises in Britain and there infesting the manufactured product is greatest in the case of *E. cautella*, since neither *L. serricorne* nor *A. fasciculatus* develop under temperate storage conditions.

Other insects found infesting stored palm kernels in southern Nigeria are *Carpophilus dimidiatus* (F.), *Oryzaephilus surinamensis* var. *mercator* Fauv. and, occasionally, *Pachymerus lacerdae* (Chevr.), but losses due to insects are at present negligible. The development of *T. castaneum*, *P. interpunctella* and *E. cautella* in groundnuts in transit storage in the south continues, but that of *Trogoderma granarium* Everts is retarded [see preceding abstract]. *Aphanus sordidus* (F.) occurs frequently on bagged groundnuts and benniseed

[*Sesamum orientale*] at two ports, and the fruits of *Capsicum* become infested by *T. castaneum* while in transit or storage.

The control measures adopted comprise the lime-washing of storage premises at least once a year to ensure that they are reasonably clean, which is difficult to carry out in ports, as the warehouses are in continuous use, and the trapping of adults of *E. cautella* and *L. serricorne* on the mid-ribs of oil-palm leaves coated with an adhesive [**30** 212] and of various insects by means of weak soap solution in shallow pans placed on the floors of the storage premises. Neither trapping method gives any appreciable control. The numbers of insects caught in pans of soap solution in a storehouse containing cacao and palm kernels during eight days in September-October are given in a table. The most numerous were *N. rufipes*, *L. serricorne* and *E. cautella*.

HOWE (R. W.) & BURGES (H. D.). **Studies on Beetles of the Family Ptinidae. VII. The Biology of five Ptinid Species found in Stored Products.**—*Bull. ent. Res.* **43** pt. 1 pp. 153–186, 2 pls., 6 figs., 64 refs. London, 1952.

In this part of a series [*cf. R.A.E.*, **40** 68, etc.], an account is given of experiments to determine why *Niptus hololeucus* (Fald.), *Trigonogenius globulus* Sol. and *Gibbium psylloides* (Czenp.), which are established in Britain, remain comparatively unimportant as pests of stored products there and whether the recently introduced species, *Stethomezium squamosum* Hinton [**31** 368] and *Eurostus hilleri* (Rtt.) [**28** 531] are likely to become pests in the future. They were reared on wheatfeed, flour, fishmeal or a synthetic diet, at various temperatures and humidities, and the results are given in numerous tables and discussed. None of the five showed any considerable differences in biology from *Ptinus tectus* Boield. [*cf.* **38** 478–479], and they are unlikely to be as important as that species, since all except *E. hilleri* normally produce only one generation a year and none has such a high rate of egg production. Further details are given of the disease that attacked cultures of *T. globulus* and *N. hololeucus* [**38** 478]. It caused high mortality of larvae and pupae and is considered to have been caused by a virus or bacterium, since it was apparently not of sporozoan origin. It appeared to be transmitted in the frass, but attempts to infect Ptinids of other species failed.

SALT (G.). **The Arthropod Population of the Soil in some East African Pastures.**—*Bull. ent. Res.* **43** pt. 1 pp. 203–220, 3 figs., 18 refs. London, 1952.

The estimation of the total arthropod population of pasture soil in England from data obtained by a sampling method originally devised for the extraction of wireworms [*R.A.E.*, A **32** 306] gave numbers many times greater than any previously obtained by other methods [**38** 228]. The technique, which is described, was later applied to East African soils, and the following is taken from the author's summary of the work. Eleven soil samples from pastures near Moshi, Tanganyika, and at Kawanda, Uganda, yielded collections representing a population of 54,565 arthropods per sq. metre in the top 6 ins. of soil or, if three samples are adjusted in conformity with biological indications, of 38,417 per sq. m. Nine soil samples from cultivated ground gave collections representing a population of 24,423 arthropods per sq. m. in the top 12 ins. (in some cases 8 ins.) of soil. In England, 25 soil samples from a pasture near Cambridge, examined in a strictly comparable manner, gave collections representing 90,238 arthropods per sq. m. in the top 6 ins. of soil. It appears that the arthropod population in the uppermost 6 ins. of East African pasture soil is much smaller than that in an English pasture. The causes and consequences of the smaller arthropod population of tropical soil are briefly discussed, and a connection is suggested between the meagre arthropod (and

Gómez Clemente (F.). **Experiencias sobre el empleo del D.D.T. contra la "mosca de las frutas"** (*Ceratitis capitata*). [Experiments on the Use of DDT against *C. capitata*.]—*Bol. Pat. veg. Ent. agric.* **16** (1948) pp. 253–272, 9 figs. Madrid, 1949.

In the Province of Valencia, *Ceratitis capitata* (Wied.) is particularly injurious to late varieties of peach that ripen in August. The influence of climate, and especially of temperature, on the date of appearance of this fruit-fly is discussed. Conditions were such that infestation was slight in 1946–47, but heavy in 1948, and in that year, treatment with DDT was compared with the use of glass bait-traps for control. The latter contained a 4 per cent. solution of ammonium phosphate and were exposed at the rate of two per tree from the second week in July until harvest a fortnight later. The numbers of flies caught per tree averaged nearly 29, and rather more were taken in traps on the south than on the north sides of the trees [*cf. R.A.E.*, A **30** 480] ; 70 per cent. of all flies caught were females. Some 15–20 per cent. of the fruits were attacked, whereas the majority of the peaches in adjacent orchards were infested and had fallen to the ground. Some of the traps used were of the type with a narrow sealed neck, to retard evaporation [*cf.* **35** 151], and these proved very satisfactory ; the others had to be refilled after a week.

Applications of DDT were made on 5th July, when the flies first appeared in the orchard, and again on 16th. A 5 per cent. DDT dust and an emulsified solution of 0·1 per cent. DDT were insufficiently effective, but a suspension spray of 0·25 per cent. DDT reduced the percentage of fruits infested (by weight) to 12·7, as compared with 80–90 for no treatment. The numbers of trees in these tests were very small. In tests of the effectiveness of residues, trees were sprayed in the field and small branches removed to the laboratory at intervals of 1–15 days after treatment. Ten adults of *C. capitata* were then enclosed with each, and subsequent mortality noted. The emulsion spray and a suspension of 0·1 per cent. DDT gave low mortalities throughout, but the 0·25 per cent. suspension gave complete mortality in 72 hours for 4 days after treatment and 90 per cent. in 72 hours and 100 in 96 hours 9 and 15 days after it.

Thalenhorst (W.). **Die Koinzidenz als gradologisches Problem. Eine synökologische Studie.** [Coincidence as an Outbreak Problem. A Study in Synoecology.]—*Z. angew. Ent.* **32** pt. 1 pp. 1–48, 6 figs., 102 refs. Berlin, 1950.

In nature, parasites and predators rarely attain their theoretical maximum efficacy and forecasts of the probable effectiveness of biological control, based on the density of populations of host and natural enemy, are often incorrect. One reason is that the dispersion of insects over a given area is never uniform, even under outbreak conditions, and differences in the mobility of host and parasite or predator place sometimes one and sometimes the other at a disadvantage. Account must therefore be taken of the probability of their meeting. Gregarious and migratory instincts are two factors causing unequal distribution. Others are the presence of suitable food or oviposition sites, microclimatic and other preferences, and the existence of natural barriers preventing dispersal, all of which tend to draw members of the same species together, and overcrowding, insufficient food-supply and wind, which tend to drive them apart. Furthermore, every species strives to extend the area of its activities and to increase its population in that already occupied. Dispersion throughout the vertical plane from tree-top to subsoil is governed by the interaction of similar factors, some of which are favourable and others unfavourable for effective biological control. Various possible situations arising from different degrees of dispersion of host and parasite and the extent of parasitism to be expected

in each are discussed and illustrated from examples drawn mainly from the literature on forest entomology. Distribution in time, including overlap between generations, the presence of suitable hosts at the right seasons, and the occurrence of diapause, is similarly analysed. It is concluded that the variables are too many and complex to be compressed into a single mathematical formula and that the host-parasite relation should be regarded in its particular context in space and time rather than in the light of the ratio of one to the other over a unit area.

STEUDEL (W.). **Die Wirkung einiger Kontaktgifte auf Nonnenraupen im klimatischen Optimum.** [The Effect of some Contact Poisons on Larvae of the Nun Moth at the Climatic Optimum.]—*Z. angew. Ent.* **32** pt. 1 pp. 49–85, 14 figs., 40 refs. Berlin, 1950.

An account is given of laboratory experiments carried out in Germany in 1938–39 in which first- and third-instar larvae of the nun moth [*Lymantria monacha* (L.)] reared mainly on oak at 22°C. [71·6°F.] and 100 per cent. relative humidity, which afford practically optimum conditions [*cf. R.A.E.*, A **27** 564], were dusted in a bell-jar with proprietary preparations of DNC (dinitro-o-cresol), pyrethrum or derris, and the effects of treatments causing incomplete mortality on the subsequent development of the survivors were studied. The results are given in graphs and tables. Only larvae that had hatched during the same 24 hours were used in any one test, exposure was for 15 seconds, and the larvae were transferred to undusted food after treatment. Larvae dusted in the first instar suffered high mortality from small doses of all three materials, and though the development of the survivors was temporarily retarded, their subsequent growth was normal. About four times as much insecticide was needed to give equal mortality of third-instar larvae, and differences among the materials became more apparent. DNC was highly toxic and rapid in action, but had no appreciable delayed effect. Pyrethrum and derris were initially less toxic and often required several days to cause maximum mortality, yet even very small doses had a permanent weakening influence. A few of the survivors died in later instars, but only in the case of derris could this be attributed with certainty to the treatment. Others developed more slowly, and there was considerable disparity in the dates at which dusted larvae of the same group moulted. Most of the control insects pupated after five instars, but many larvae treated with derris or pyrethrum pupated after six, the percentage doing so being greater for survivors of treatments that caused high mortality. This tendency was especially marked in larvae giving rise to females, one that survived treatment with derris that caused 90 per cent. mortality pupating after seven instars. The pupae from larvae dusted with derris or pyrethrum were smaller in diameter and the females that emerged from them laid fewer eggs than in the controls.

It is concluded that the more rapid the action of the insecticide, the less was its delayed effect, and that DNC applied to larvae reared under optimum conditions eliminated the weaker individuals but had no effect on the stronger ones and thus had a selective force. This was not the case with derris or pyrethrum.

WATZL (O.). **Zur Lebensweise und Bekämpfung der Wintersaateule (*Agrotis segetum* Schiff.). Erste Mitteilung : Fangversuche zur Faltererbeutung.** [On the Bionomics and Control of *A. segetum*. First Communication : Experiments with Traps against the Adults.]—*Pflanzenschutzberichte* **5** pt. 9–10 pp. 345–358, 15 refs. Vienna, 1950. (With a Summary in English.)

The Noctuid, *Agrotis segetum* (Schiff.), has two generations a year in eastern Austria, where the larvae cause considerable damage to many plants, notably

KELSEY (J. M.), HOY (J. M.) & LOWE (A. D.). **New Treatments for Control of Subterranean Grass Caterpillars.**—*N. Z. J. Agric.* **80** no. 2 pp. 123–126, 9 figs. Wellington, N.Z., 1950.

KELSEY (J. M.). **Grass-grub and Grass Caterpillar Control.**—*Op. cit.* **83** no. 2 pp. 113, 115–117, 119, 121–122, 10 figs., 6 refs. ; no. 3 pp. 195, 197, 199–200, 5 figs., 3 refs. 1951.

In the first of these papers, the authors give a short account of the bionomics of *Oxycanus* spp. in the Canterbury district of New Zealand [*cf. R.A.E.*, A **35** 62], where damage to pastures by the larvae has greatly increased in recent years. The hot dry conditions on close-grazed unirrigated land destroy many eggs and larvae of these Hepialids in October–December, but the conditions on irrigated land are excellent for survival during this critical period. With the increase in population, the control given by the standard bait of 2 lb. paris green in 25–30 lb. bran per acre [*cf.* **33** 183, etc.] has decreased, and it has proved ineffective against infestations of more than six larvae per sq. ft. DDT and BHC (benzene hexachloride) were therefore tested [*cf.* **39** 411]. Applications of 0·75 cwt. superphosphate containing 1 or 0·5 per cent. γ BHC per acre, 50 lb. bran containing 1 lb. 13 per cent. γ BHC, and 0·75 cwt. superphosphate containing 2 and 1 per cent. DDT gave 100, 75, 75, 70 and 60 per cent. control, as compared with no treatment, of a population of 20 larvae per sq. ft., and were better than 2 lb. paris green in 50 lb. bran or 0·75 cwt. superphosphate or 3 lb. paris green in 60–70 lb. bran or 1 cwt. superphosphate. Sawdust substituted for bran gave poor results [*cf.* **39** 411]. The bran bait was difficult to apply by farm implements other than topdressers of the rotary and screw-feed types. The costs of the various treatments are discussed, and the advantages of the use of treated superphosphate indicated. It is pointed out that straw should not be left on pasture, as it shelters the young larvae and prevents insecticides from reaching the ground.

The second part of the second paper contains further information on the appearance, habits and control of *Oxycanus* spp., the most injurious of which in pastures is *O. cervinatus* (Wlk.). Rolling at night to kill the larvae while feeding and the use of light-traps and fires against the adults are ineffective, but repeated cultivation exposes the larvae and pupae to destruction by birds. Directions are given for mixing and applying DDT and BHC in superphosphate or in bran baits.

In the first part of the second paper, the author states that serious losses are caused in New Zealand by Lamellicorn larvae. The most important species is *Odontria zealandica* (White), which mainly infests pasture land and has increased with the extension and improvement of it. Other economic species are *O. smithii* Broun and *O. striata* (White), which are injurious in market gardens, *O. xanthosticta* (White) and *O. puncticollis* Broun, which damage nursery stock, and *Pyronota* spp., which damage forest nursery stock and pastures in certain districts. They all complete their development in 12 months, but *O. smithii* and *O. striata* appear to have overlapping generations, and a few larvae of *O. zealandica* occur throughout the year. The life-history of the last and measures for its control are reviewed, largely from the literature [*cf.* **34** 20, etc.]. Insect and other predators destroy both adults and larvae, and a bacterium that causes a milky disease sometimes gives good control of larvae in the first two instars. A nematode of the genus *Mermis* is plentiful in localised areas in Canterbury, but gives little control, and cannibalism appears to be the main factor limiting larval populations. Another bacterium causing milky disease [*Bacillus popilliae*] and another nematode [*Neoaplectana glaseri*] have been introduced from the United States, and the latter gave good control in the laboratory. Several Thynnid parasites of the larvae have

recently been introduced from Australia, and two have been recovered in the field, where two host species are apparently attacked.

Tests in 1947–50 with DDT and BHC applied to pasture in dusts or with superphosphate showed that both compounds killed larvae in the first two instars and apparently incapacitated but did not kill those in the third. DDT retained its effectiveness for longer than BHC, and was still very toxic to both *Odontria* and *Oxycanus* a year after application. DDT in superphosphate is recommended at a dosage of 1 lb. in 1 cwt. per acre for general grazing land, 1·5 lb. per acre for valuable pastures and lucerne, and 2 lb. per acre where *Oxycanus* is also present. Applications can be made at any time, but those made between April and August will not control the third-instar larvae. Treatments made between September and November give good results by the end of the following February or March. They should be applied when the pasture is close grazed and dry, to avoid adherence of the insecticides to the grass, or during heavy rain, so that they will be washed to the ground. Spraying of pastures and hedgerows with 1·25 lb. BHC or DDT in 160 gals. water per acre gave significant reductions in adult numbers, but did not prevent heavy oviposition. Low-volume sprays applied to pasture were ineffective against the larvae, as nearly all the insecticide was retained on the grass and eaten by stock, but high-volume sprays (1,500 gals. containing 1 lb. DDT or γ BHC per acre) gave good control. Applications in July were as effective as those in November, and DDT was superior to BHC, DDD [dichlorodiphenyldichloroethane] or chlordan at the dosages tested. Lawns were protected from both *Odontria* and *Oxycanus* for two years by treatment with 1·5 lb. 50 per cent. DDT in 61 lb. standard lawn topdressing, dry sand or soil per 1,000 sq. yards and for one year by 2 lb. 10 per cent. γ BHC per 1,000 sq. yards.

O'Connor (B. A.). **Some Insect Pests of Tonga.**—*Agric. J. Fiji* **20** no. 2 pp. 47–57, 17 refs. Suva, 1949.

Notes are given on pests found on coconut, banana and *Citrus* in Tonga between 21st April and 26th May 1949, with records of numerous other insects observed on crops of less importance. Coconut is attacked by *Graeffea crouanii* (Le Guillou) throughout Tonga, but this Phasmid seldom occurs in such numbers as to be a serious pest, though severe infestations are said to follow dry periods. Notes are given on its appearance, bionomics and control. It is possibly attacked by the predacious ant, *Tapinoma melanocephalum* (F.). *Agonoxena argaula* Meyr., *Diocalandra taitensis* (Guér.) and various Coccids also occur on coconut throughout, but are not sufficiently injurious to require control, and *Coleoneura* (*Tirabatha*) *trichogramma* (Meyr.), *Promecotheca reichei* Baly and unidentified Tettigoniids are present but are of little or no importance.

Banana is severely damaged by *Nacoleia octasema* (Meyr.), which occurs throughout Tonga, and was infested by *Cosmopolites sordidus* (Germ.) in every grove inspected ; control measures against these are reviewed. *Planococcus* (*Pseudococcus*) *citri* (Risso) and *Pentalonia nigronervosa* Coq. were found on banana on one island but were of no importance.

Citrus is heavily infested by *Dacus kirki* Frogg. and *D. facialis* Coq. throughout Tonga, the former being somewhat more numerous, and measures are suggested against them. No parasites emerged from several hundred larvae collected in the field, but a single example of the Braconid, *Phaenocarpa leveri* Nixon, was found under a fallen fruit containing numerous larvae of *Dacus* and Drosophilids. Several Coccids severely damage the plants, and various mites injure the fruit surfaces. The fruit-piercing moth, *Othreis fullonia* (Cl.), is present but causes little damage.

O'Connor (B. A.). **The Banana Scab Moth,** *Nacoleia octasema* **Meyr., and its Control.**—*Agric. J. Fiji* **20** no. 3 pp. 84–86, 2 refs. Suva, 1949. **Control of the Banana Scab Moth,** *Nacoleia octasema* **Meyr.**—*Op. cit.* **21** no. 1–2 p. 55, 1 ref. 1950.

It is stated in the first of these papers that *Nacoleia octasema* (Meyr.) causes considerable damage to banana in Fiji. The eggs are laid singly or in masses on the surface of the bracts enclosing the developing bunch or the proximal half of the younger leaves, mainly on the upper surface. Oviposition begins soon after the closed bunch appears, and hatching as the tip of the outer bract begins to uncurl. The larvae move to the top of the inflorescence, enter at the tip of the outer bract and make their way within 24 hours into the hands of bananas, where they feed on the surface of the developing fruits. They feed throughout the bunch while it is still erect, but move down to the distal hands and upper hands of sterile flowers as the bunch develops, producing a mass of frass and webbing and penetrating into the fruits and destroying them. The egg and larval stages lasted about six days and 2–3 weeks, respectively at a mean daily temperature of about 75°F. Pupation often occurs in the damaged hands.

For many years, fair control of the larvae has been obtained by removing the bracts when the bunch has bent over and is just beginning to pass the horizontal position and blowing in a mixture of pyrethrum powder and wood ash. Treatment with DDT would be cheaper and more reliable and would control larvae that hatched after dusting, and a dust of 2 per cent. p,p'DDT is recommended. No dust treatment can be applied soon enough after hatching to prevent all surface marking of the fruits, however, but it was thought that a spray applied before hatching might do so. Laboratory tests showed that chlordan and DDT were the most effective materials and that emulsions were better than suspensions. In field tests, unopened bunches and the surrounding leaves were sprayed, before the outermost bract had unfolded and before hatching had begun, by means of a hand atomiser with 1–2·5 per cent. of a 74 per cent. chlordan emulsion concentrate or 2–10 per cent. of a 20 per cent. DDT emulsion concentrate, at not more than 0·5 pint spray per plant. The weaker sprays were as effective as the stronger, and when the deposit dried before rain fell and there was little heavy rain for a week, the bunches were unmarked, with many dead larvae inside the outermost bract. When the DDT concentrate was applied at 2 per cent., by means of a knapsack sprayer with a 6-ft. extension pipe, during rain, with heavy rain during the next 24 hours, control was excellent, but treatment in hot, sunny weather caused several bunches to fall off within a few days, apparently owing to scorching. Later, the same spray at 0·4 per cent. applied on a hot sunny day at about 1 pint per plant was effective and did not damage the bunch.

It is not considered that spraying could replace dusting, as it is difficult to spray every bunch before some of the larvae have hatched, rain may wash the deposit away before all have done so and coverage may be inadequate, but spraying followed by dusting would result in much improved control. The destruction of the egg-masses is considered impracticable.

In the second paper, recommendations are made based on the final results of the spraying experiments. The bunch with the youngest 4–5 leaves should be sprayed with the DDT concentrate at 1 per cent. when it is about half as high as it will become in the erect position, and dusted with 2 per cent. DDT after the removal of the bracts when it is horizontal. About 70 per cent. of bunches that were sprayed but not dusted showed marking of the distal hands, indicating that some larvae hatch after the bracts have begun to fall off and enter the bunch without receiving a lethal dose of DDT. A small pneumatic

sprayer, with trigger release, which could be held up on a long pole, proved satisfactory for use.

O'Connor (B. A.). **Premature Nutfall of Coconuts in the British Solomon Islands Protectorate.**—*Agric. J. Fiji* **21** no. 1–2 pp. 21–42, 12 figs., 10 refs. Suva, 1950.

Work carried out before the war showed that premature nutfall of coconut in the Solomon Islands is caused mainly by the puncturing of the female flowers or young nuts by *Amblypelta cocophaga* China, that the tree-nesting ant, *Oecophylla smaragdina subnitida* Emery, drives out this Coreid, so that the palms bear well, and another ant, *Anoplolepis longipes* (Jerd.), has some beneficial effect, and that two other ants, *Iridomyrmex myrmecodiae* Emery and a species of *Pheidole* referred to as *P. oceanica* Mayr. tend to drive out the beneficial species, but cannot suppress *Amblypelta*, so that premature nutfall occurs where one of them is common [*cf. R.A.E.*, A **29** 325].

In the course of a survey carried out by the author and R. Leach in July–September 1948, in which most of the work was done on Guadalcanal but Malaita and the Russell Islands were also visited, *P. oceanica* was found only on the Russell Islands, the main species of the genus being *P. megacephala* (F.), which has similar habits and apparently occurs throughout the Protectorate. *Anoplolepis longipes* was rarely found, and other ants that nest at the base of the palms did not affect the incidence of *Amblypelta* or the relations between the important ants. It was found that since the war, many non-bearing areas on Guadalcanal had come back into production, coinciding with a much wider dispersal of *Oecophylla*. Before the war, cattle had been grazed in the plantations and all fallen fronds burnt, but during it, the cattle were removed, a profuse undergrowth, including creeping vines, trees and shrubs, developed and DDT solutions were applied from the air as a precaution against malaria. The free development of undergrowth and the presence of fallen fronds apparently favoured *Oecophylla* by providing runways that avoided the bases of the palms where the workers were destroyed by *Pheidole*, which nests there. When nests of *Oecophylla* were placed in palms in areas in which *Pheidole* was abundant and nutfall heavy, and the palms were connected with adjacent ones by lines of fronds laid on top of the undergrowth and fronds were placed with the butt end on the ground and the other end leaning against the trunk, observations over six weeks showed that *Oecophylla* survived and began to exert remarkable control of *Amblypelta* almost immediately after its introduction. In the Russell Islands, neither *Amblypelta* nor premature nutfall has been reported, and although the ground under the palms was clear and *Pheidole* present, *Oecophylla* was dominant except where the fronds and fallen nuts had been gathered into lines between the rows of palms, possibly because the plantations were younger than those in Guadalcanal and it had not yet been driven out by *Pheidole* or because the latter had been introduced at a later date.

Since *Iridomyrmex* nests in great numbers in the crowns of the palms as well as in cuts and depressions in the trunks and at the base, there is little likelihood of establishing *Oecophylla* without prior elimination of this ant in areas in which it predominates, and attempts should therefore be made to control *Amblypelta* in them by means of parasites or insecticides. It was observed in such areas on Malaita that *Oecophylla* was present on a few palms, all of which had nests of *Pheidole* at the base and ample undergrowth, so that although *Oecophylla* cannot successfully invade *Iridomyrmex* territory, it can survive where *Pheidole* prevents *Iridomyrmex* from occupying a palm. Yields in areas infested by *Iridomyrmex* were good only if *Oecophylla* was effective in the vicinity.

Poison baits, bands of adhesive, DDT dusts and sprays or dusts of benzene hexachloride were ineffective against *Pheidole* and *Iridomyrmex*, but thorough spraying of the base of the palm with 0·5 per cent. of a 74 per cent. chlordan emulsion concentrate gave good mortality of both. Against *Pheidole*, the bark was cut away to expose the nests and the base of the palm sprayed to a height of about a foot, and against *Iridomyrmex*, all loose bark and covered runways were removed and the trunk sprayed to a height of six feet. About one pint per tree was used against *Pheidole* and about two pints against *Iridomyrmex*, applied with a rather coarse jet, and all cracks and crevices were thoroughly treated. The residue killed all ants passing over it for 5–6 days, but three weeks later, *Iridomyrmex* was still numerous in the crowns of treated palms, and spraying of the whole palm would be necessary for control. DDT in dieseline was also effective.

Notes on the appearance and habits of *Amblypelta*, *Oecophylla*, *Pheidole* and *Iridomyrmex* are included. A complete list of the ants found is given in an appendix, and there is a further appendix in which R. Leach describes in some detail the stages in the development of the nuts, the way in which *Amblypelta* feeds and the nature of the injury caused. The scars formed on the surface of the nuts were a useful indication of the history of the infestation.

O'Connor (B. A.). *Trichopoda pennipes* **F. in Fiji and the British Solomon Islands.**—*Agric. J. Fiji* **21** no. 3 pp. 63–71, 7 figs. Suva, 1950.

A consignment of *Trichopoda pennipes* (F.), a Tachinid parasite of Pentatomids and Coreids, was received in Fiji in December 1949 from Florida with a view to liberation against *Amblypelta cocophaga* China on coconut in the Solomon Islands and also against *Nezara viridula* (L.) and other phytophagous bugs in Fiji, though *N. viridula* is there rather well controlled by the egg-parasite, *Microphanurus basalis* (Woll.). The technique used in breeding the Tachinid is described in some detail; adults of *N. viridula* were the most suitable hosts, but eggs were laid indifferently on bugs of various species, the females depositing more than 100 each. The combined egg and larval stages and the pupal stage lasted 12–23 days and 11–13 days, respectively, during the warm season, and the adults survived for about 6–7 days. When taken to the Solomon Islands, *T. pennipes* oviposited on both *Amblypelta* and *Axiagastus cambelli* Dist., which also feeds on coconut, but 11 of 18 adults of *Amblypelta* on which eggs were laid were living 14 days later and no parasites were found in them, and no puparia were obtained from the dead examples, so that control seems unlikely. However, in May 1950, under favourable weather conditions, 205 fertilised females and 74 young males of the Tachinid were liberated in an area on Malaita where *Amblypelta* caused almost complete premature nutfall and smaller numbers in areas on Guadalcanal in which *Amblypelta* had already been controlled by the ant, *Oecophylla smaragdina submitida* Emery [*cf.* preceding abstract].

Simmonds (H. W.). **Premature Nutfall in Taveuni.**—*Agric. J. Fiji* **22** no. 1 pp. 22–24. Suva, 1951.

The author visited the island of Taveuni, Fiji, in June 1951 to investigate the causes of the premature nutfall of coconut reported there. A great deal of it was due to the inability of the trees to mature the exceptionally heavy crop present and to damage by rats, but in places in which there was a heavy growth of guava and the soil and air were damp, there was a rotting on the palms that could not be associated with any definite agency, although

Diocalandra taitensis (Guér.) was invariably present in the stems of the spikes. Attack by this weevil was not always followed by fungous infection, however. In other localities, the Cossid, *Acritocera negligens* Btlr., caused early nutfall, the larvae destroying whole spikes on some palms ; cultivating the ground below the palms might control it, since pupation occurs there. The Phasmid, *Graeffea crouanii* (Le Guillou) (*cocophaga* (Newp.)), and *Agonoxena argaula* Meyr. were present throughout the island, the former killing some of the palms, and *Aspidiotus destructor* Sign. was abundant on avocado, in spite of the presence of the predator, *Cryptognatha nodiceps* Mshl., and the parasite, *Aphytis chrysomphali* (Merc.), but was not observed on coconut.

GÓMEZ CLEMENTE (F.). **Estudio biológico del lepidóptero *Chilo simplex* Butl. en los arrozales valencianos.** [A biological Study of *C. suppressalis* in the Rice-fields of Valencia.]—*Bol. Pat. veg. Ent. agric.* **16** (1948) pp. 1–22, 8 figs., 4 refs. Madrid, 1949.

Infestation of rice in Valencia by *Chilo suppressalis* (Wlk.) (*simplex* (Btlr.)) [*cf. R.A.E.*, A **29** 458] varies considerably in different years and localities according to the weather, and investigations on the bionomics of this Pyralid were therefore undertaken in 1946–47, particular attention being paid to the effects of temperature. There were two generations a year, with a partial third under favourable conditions. Adults of the overwintered generation emerged early in March from material kept in the laboratory at an average temperature of 18–20°C. [64·4–68°F.], but few females oviposited and the eggs laid were not viable, probably because the food supplied was inadequate. When infested rice stubble was kept over winter in outdoor cages, the first adults emerged on 20th April, at an average temperature of 16°C. [60·8°F.]. The moths emerged in the field over a considerable period, and it is considered that the factors affecting the date of emergence in Japan [**20** 329] are also operative in Spain. Most of the adults survived for 4–8 days. Pairing occurred a few hours after emergence, and oviposition began 24–48 hours later. Females caged on outdoor plants deposited an average of 209 eggs each in 2–4 days, grouped on the leaves or on the cloth of the cages. In the field, the eggs were found largely on the undersides of the leaves. The egg stage lasted 5–6 days at 26–28°C. [78·8–82·4°F.], and twice as long at 20–22°C. [68–71·6°F.]. Larvae of the first generation fed on the young leaves and leaf sheaths and moved from plant to plant by suspending themselves on threads and allowing themselves to be transported by wind [*cf.* **18** 33]. Some that hatched in late May and early June in the laboratory pupated after 30–40 days at average temperatures of about 27°C. [80·6°F.]. The larvae normally selected a leaf sheath about half-way between the water level and the tip of the plant for pupation. The pupal stage lasted about a week, and the adults appeared in July.

Larvae of the second generation were present in August, and up to 15 or more were observed per plant. They did not move from the plants on which they hatched, and mined in the stalks, becoming full-fed before winter. Some pupated and gave rise to adults in September, but the majority overwintered in the straw or stubble mid-way between two nodes. These pupated in the following spring, the pupal stage lasting 10 and 20 days at 17·6 and 15·4°C. [about 63·7° and 59·7°F.], respectively. A few third-generation larvae are produced in autumn, but mortality among them is probably very high.

By applying the methods of Blunk and Bodenheimer [*cf.* **23** 296, etc.], it is calculated that the threshold of development for *C. suppressalis* is 14·9°C. [58·82°F.], the optimum for development about 26°C. and the thermal constant 601·5 day-degrees C. [1,082·7 F.].

PLANES (S.). **Influencia de la temperatura en el desarrollo del *Earias insulana*.** [The Influence of Temperature on the Development of *E. insulana*.]—*Bol. Pat. veg. Ent. agríc.* **16** (1948) pp. 23–30, 2 graphs, 1 ref. Madrid, 1949.

In this account of more detailed investigations on the development of *Earias insulana* (Boisd.) on cotton in Spain than those already recorded [*R.A.E.*, A **36** 197], a table is given showing the durations of the immature stages in field or laboratory at various temperatures. The egg stage ranged from 4–5 days at about 28°C. [82·4°F.] to 17 days at 14·5°C. [58·1°F.], at which only one of 15 eggs hatched, the larval stage from 9 days at about 26°C. [78·8°F.] to 28 at 13·5°C. [56·3°F.], at which only one larva out of three batches survived, and the pupal stage from 6–7 days at about 29°C. [84·2°F.] to about a fortnight at 16°C. [60·8°F.], at which survival was likewise low. These three stages and the preoviposition period lasted 4, 14, 9 and 3 days and 8, 25, 20 and 9 days among insects reared in the insectary at average temperatures of 26° and 19°C. [66·2°F.], respectively, and it is calculated from these figures by the method of Blunk and Bodenheimer [*cf.* **23** 296, etc.] that the threshold of development is 12·44°C. [54·39°F.], a value closely corresponding to the laboratory results, and the thermal constant 407 day-degrees C. [732·6 F.]. The adults were much more resistant to cold, surviving for 41 days at 8·5°C. [47·3°F.] and 14–15 days at 6°C., though no eggs were laid. It is suggested that development varies not only with the average temperatures, but also with the minima experienced. This would account for the reduction in infestation in inland and more northerly districts, where similar averages but lower minima are recorded, as compared with the south-eastern coast. It is also suggested that very high or very low humidities disfavour infestation.

GÓMEZ-MENOR (J.). **Chinches de huerta : Hemípteros Heterópteros que ocasionan daños a los cultivos hortícolas.** [The Bugs of Kitchen Gardens : Hemiptera Heteroptera injurious to Vegetable Crops.]—*Bol. Pat. veg. Ent. agríc.* **16** (1948) pp. 31–68, 27 figs., 25 refs. Madrid, 1949.

The Heteroptera that are of importance as pests of vegetable crops in Spain are the Pentatomids, *Nezara viridula* (L.), *Palomena prasina* (L.), *P. viridissima* (Poda), *Eurydema ornatum* (L.) and *E. oleraceum* (L.), the Pyrrhocorid, *Pyrrhocoris apterus* (L.), which is sometimes predacious, and the Lygaeid, *Nysius ericae* (Schill.). Keys are given for their identification, together with descriptions of the various stages and notes on synonymy, bionomics, food-plants and distribution. Information on a few related species is included for comparison.

BELLOD (M.). **Acción del D.D.T. y del 666 sobre las orugas de *Aglaope infausta* L., *Episema caeruleocephala* (L.) y *Malacosoma neustria* (L.).** [The Action of DDT and Benzene Hexachloride on Larvae of *A. infausta*, *Diloba coeruleocephala* and *M. neustria*.]—*Bol. Pat. veg. Ent. agríc.* **16** (1948) pp. 69–90, 9 figs., 1 ref. Madrid, 1949.

Experiments were carried out in the laboratory and field in Valencia in 1946–48 on the value of various proprietary preparations containing 5 per cent. DDT, one containing 15 per cent. mixed isomers of BHC (benzene hexachloride) and two containing 2 and 3 per cent. of the γ isomer in suspension sprays against larvae of *Aglaope infausta* (L.), *Diloba* (*Episema*) *coeruleocephala* (L.) and *Malacosoma neustria* (L.) on almond. The sprays

were applied to leaves on which larvae were subsequently confined, to larvae that were then transferred to untreated leaves, or to leaves bearing larvae, and the results are shown in numerous tables. The DDT preparations at 1 per cent. gave complete mortality of *A. infausta* in 3–6 days in all cases except that of larvae about to pupate that were confined on treated leaves, when the mortality percentages were 68–85 and 80–90 after 4 and 6 days, respectively. They usually gave complete mortality of *D. coeruleocephala*, provided that the larvae had not completed three-quarters of their growth, and of *M. neustria* during the first half of the larval stage, but older larvae were more resistant. Treated leaves were little damaged in all these tests. Although inferior to DDT, the BHC products at 1–2 per cent. generally gave good control of young larvae of all three species in the laboratory, but were unsatisfactory in the field.

ALFARO (A.). **Existencia en España del Membracido** *Ceresa bubalus* **F.** [The Existence in Spain of the Membracid, *C. bubalus*.]—*Bol. Pat. veg. Ent. agríc.* **16** (1948) pp. 105–118, 10 figs., 15 refs. Madrid, 1949.

Nymphs of *Ceresa bubalus* (F.), which had not previously been recorded from Spain, were discovered in June 1947 on cotton plants growing beneath young olive trees at Zaídin (Aragon). The females oviposit in incisions made in the bark of trees, and characteristic scars were found on the olive trees and also, in 1947–48, on apple, plum, pear and apricot growing in several districts near Saragossa, usually in close proximity to lucerne [*cf. R.A.E.*, A **18** 370]. All stages of this Membracid are described, and its distribution, food-plants, bionomics and control are reviewed, mainly from the literature [*cf.* **27** 689, etc.]. Nymphs collected in the field and reared on lucerne gave rise to adults in late June and early July, the males appearing before the females.

DOMÍNGUEZ GARCÍA-TEJERO (F.). **Los " gusanos de alambre " : Elatéridos de intéres agrícola.** [Wireworms : Elaterids of agricultural Interest.]—*Bol. Pat. veg. Ent. agríc.* **16** (1948) pp. 119–156, 23 figs., 38 refs. Madrid, 1949.

In view of the damage caused by wireworms, notably *Agriotes lineatus* (L.), to crop plants in Spain, the author gives a general account of the morphology and life-history of Elaterids, keys to the genera and the species of some of those found in Spain, short descriptions of the adults of each species, records of general and local distribution and of the plants attacked, and a summary of work in other countries on the control of the larvae, with special reference to Spanish conditions, including the use of soil treatments with DDT and benzene hexachloride.

RUIZ CASTRO (A.). **La polilla del olivo en España,** *Prays oleellus* **(F.).** [*P. oleellus* in Spain.]—*Bol. Pat. veg. Ent. agríc.* **16** (1948) pp. 165–202, 19 figs., 11 refs. Madrid, 1949.

Prays oleellus (F.) caused considerable damage to olive in the Provinces of Seville and Córdoba in 1948, and, as a preliminary to investigations there, the author gives descriptions of all stages and a review of knowledge on its bionomics and control [*cf. R.A.E.*, A **36** 193–194, etc.]. A list of recorded parasites and hyperparasites of *P. oleellus* is included. The most effective primary parasite is apparently *Ageniaspis fuscicollis* (Dalm.) subsp. *praysincola* Silv., and it is stated that although *A. fuscicollis* is widely distributed in Spain, it has not been observed to attack *P. oleellus* there, possibly owing to the absence of this subspecies [but *cf.* **10** 598].

earthworm) population and the large amount of ligneous material found in the soil samples examined. This connection may also bear on the paucity of humus in some tropical soils.

Distribution Maps of Insect Pests.—Series A, nos. 1–12 ; 13–18. London, Commonw. Inst. Ent., 1951–52. Annual subscription (for 12 maps) 6*s.* post free ; single maps 1*s.* each, post free ; loose leaf binder, to hold approximately 500 maps, £1.

These maps are the first 18 of a series showing the distribution of insect pests. Each is devoted to an individual pest, and, in addition to the map on which its distribution is outlined, comprises a list of the records on which this distribution is based. These records include references to literature, mainly but not exclusively that noticed in this *Review*, and also data taken from the collections in the British Museum or based on material received for identification by the Commonwealth Institute of Entomology. The principal food-plants of each pest are indicated, and references are also made to detailed lists of the food-plants of a few of the polyphagous species.

The pests with which Maps 1–18 are concerned are, respectively, *Ceratitis capitata* (Wied.), *Aonidiella aurantii* (Mask.), *Chrysomphalus dictyospermi* (Morg.), *C. ficus* Ashm., *Diatraea saccharalis* (F.), *Leptinotarsa decemlineata* (Say), *Quadraspidiotus perniciosus* (Comst.), *Cydia molesta* (Busck), *C. pomonella* (L.), *Gnorimoschema operculella* (Zell.), *Pyrausta nubilalis* (Hb.), *Anthonomus grandis* Boh., *Platyedra gossypiella* (Saund.), *P. scutigera* Hold., *Heliothis armigera* (Hb.), *Popillia japonica* Newm., *Eriosoma lanigerum* (Hsm.) and *Aphis gossypii* Glov.

Fahey (J. E.) & Rusk (H. W.). **Determination of DDT Residues on Corn.**—*Analyt. Chem.* **23** no. 12 pp. 1826–1829, 1 fig., 7 refs. New York, N.Y., 1951.

The following is substantially the authors' summary. In the study of the relation of insecticide application to DDT residues on maize plants, it was necessary to have an accurate and precise method for routine analysis of a large number of plant samples, and the organic-chlorine, Schechter-Haller and Stiff-Castillo metnods of DDT determination were compared for accuracy, precision (reproducibility of results) and adaptability to routine analysis. The Stiff-Castillo technique [*R.A.E.*, A **33** 264] was found to be the most rapid and simple, and nearly equal in precision and accuracy to the Schechter-Haller method [**33** 368], which is accurate and precise but slow and tedious and not well adapted to routine analysis. The organic-chlorine method [**38** 382], though adaptable to routine analysis, is less accurate and precise in the low range of residues (less than 4 parts per million DDT) usually found on maize plants and less specific for DDT than the other two methods. A rapid, accurate and precise technique is described for the determination of DDT residues on maize plants by the Stiff-Castillo method. It would be equally applicable to routine determination of DDT residues on other plants that give similar residue solutions.

Giang (P. A.) & Hall (S. A.). **Enzymatic Determination of organic Phosphorus Insecticides.**—*Analyt. Chem.* **23** no. 12 pp. 1830–1834, 5 figs., 8 refs. New York, N.Y., 1951.

The following is largely based on the authors' summary. The wide use of toxic organic phosphorus insecticides has created a need for sensitive methods

for their detection as spray residues on plant materials. As the organic phosphorus insecticides inhibit the enzyme cholinesterase in varying degree [*cf. R.A.E.*, A **39** 427, etc.], this property was used as the basis for an analytical method. Ether extractives of plant materials that had been sprayed with insecticide were allowed to react for 30 minutes at 25°C. [77°F.] with standard cholinesterase and buffer solution to effect partial inhibition of the enzyme ; standard acetylcholine chloride solution was added as the substrate and allowed to react for 60 minutes at the same temperature, and the pH change was measured and converted to percentage inhibition and thence to micrograms of insecticide by comparison with a standard curve for the material under investigation. The method was used to determine spray residues of tetraethyl dithiopyrophosphate, which is a fairly strong inhibitor of cholinesterase, tetraethyl pyrophosphate, E-1059 [diethyl ethylmercaptoethyl thiophosphate], O-ethyl O-p-nitrophenyl benzenethiophosphonate (EPN), parathion and paraoxon (diethyl p-nitrophenyl phosphate) ; parathion, which is not a strong inhibitor, was readily converted to paraoxon, a very strong one, and thus measured in hundredths of a microgram by the enzyme method. Methylparathion and schradan (octamethyl pyrophosphoramide) were too weakly inhibitive to be determined by this method.

EDWARDS jr. (F. I.). **Report on Parathion.**—*J. Ass. off. agric. Chem.* **34** no. 3 pp. 686–689, 4 refs. Washington, D.C., 1951.

In this supplementary report on methods of assaying parathion [*cf. R.A.E.*, A **39** 210], reference is made to one utilising titration with standard sodium nitrite. The nine methods preferred or used as alternatives in 18 laboratories are shown in a table, but none is completely satisfactory, and in view of the necessity for some standard procedure, it is recommended that collaborative studies should be carried out on titration with sodium nitrite, polarographic determination and any new methods that show promise.

ACREE jr. (F.) & HALLER (H. L.). **Wilfordine, an insecticidal Alkaloid from *Tripterygium wilfordii* Hook.**—*J. Amer. chem. Soc.* **72** pp. 1608–1611, 10 refs. Easton, Pa., 1950.

BEROZA (M.). **Alkaloids from *Tripterygium wilfordii* Hook.—Wilforine and Wilfordine.**—*Op. cit.* **73** pp. 3656–3659, 6 graphs, 14 refs. Easton, Pa., 1951.

In the first of these papers, the authors describe the isolation from the roots of *Tripterygium wilfordii* [*cf. R.A.E.*, A **29** 241] of a crystalline, insecticidally active alkaloid. It was designated wilfordine and found to be an ester alkaloid consisting of a polyhydroxy nucleus esterified with five moles of acetic acid, one mole of benzoic acid and one mole of a nitrogen-containing dicarboxylic acid.

The second is an account of experiments that showed this material to contain two principal alkaloids. The first is designated wilforine, and the name wilfordine is retained for the second ; the original mixture is referred to as the methanol-insoluble fraction. The formulae for wilforine and wilfordine were calculated from molecular-weight, carbon, hydrogen and nitrogen determinations to be $C_{43}H_{49}O_{18}N$ and $C_{43}H_{49}O_{19}N$, respectively. Both compounds were found to be insecticidally active ester alkaloids that upon saponification yielded eight acid equivalents, of which six were steam volatile ; the volatile acids were composed of one mole of benzoic acid and five moles of acetic acid per mole of compound.

sugar-beet, maize and winter cereals, outbreaks lasting for up to 2–3 years. The adults are present in spring and midsummer. As no satisfactory method of control is known, investigations on the use of light-traps and baits against the adults were begun in 1948. The numbers attracted to petrol-vapour lamps in pairs or electric lights set up at the time of the first flight on sites in which the larvae had been injurious during the previous year were small, but both sexes were taken, 44 per cent. of the total being females. In the bait tests, mixtures of beer, sugar and a trace of fruit essence smeared on posts inserted into the ground attracted fair numbers of adults of both flights, and both sexes were again taken. Beer exposed to the air for 1–2 days was superior to that fresh from the bottle. Catches were slightly greater when the sugar was replaced by molasses, but smaller when apple pulp was substituted for the fruit essence. It is concluded that neither method is suitable for use in control, but that both would be of value in obtaining material for forecasting the likelihood of outbreaks.

BERAN (F.). **Auftreten und Bekämpfung des Kartoffelkäfers in Österreich im Jahre 1949.** [The Occurrence and Control of the Potato Beetle in Austria in 1949.]—*Pflanzenschutzberichte* **4** pt. 1–2 pp. 11–22, 1 map. Vienna, 1950. **Auftreten und Bekämpfung des Kartoffelkäfers in Österreich im Jahre 1950.** [The Occurrence and Control of the Potato Beetle in Austria in 1950.]—*Op. cit.* **5** pt. 9–10 pp. 359–372, 4 figs. 1950. (With a Summary in English.)

During 1949, the distribution of the potato beetle [*Leptinotarsa decemlineata* (Say)] on potato in Austria [*cf. R.A.E.*, A **39** 423] increased but little, largely owing to unfavourably cool weather in June and the control measures adopted. The isolated outbreak centre in Styria [*loc. cit.*] was almost eliminated. There was a considerable increase in 1950, however, when summer temperatures were above the average and infestation spread from Bavaria and Czechoslovakia to the northern provinces. Heavy infestations occurred in the Tyrol, Salzburg, and Upper and Lower Austria, and isolated foci were found in north-western Styria, East Tyrol and the South of Carinthia. Nevertheless, less than 10 per cent. of the potato-growing area of the country was infested. Spraying with lead or calcium arsenate or DDT and soil injection with carbon bisulphide were carried out as usual in both years and the inspection services maintained and augmented.

SCHREIER (O.). **Die Kellerlaus (*Myzodes latysiphon* Dav.) eine neue Blattlausart in Österreich.** [*Rhopalosiphoninus latysiphon*, a new Species of Aphid in Austria.]—*Pflanzenschutzberichte* **5** pt. 11–12 pp. 377–385, 1 fig., 9 refs. Vienna, 1950. (With a Summary in English.)

Rhopalosiphoninus (*Myzodes*) *latysiphon* (Davidson) was observed on stored potato tubers in Austria for the first time in March 1950, and investigations showed that it was fairly widespread in the eastern part of the country, where stored potatoes were reported to have been infested for several years. Since it may prove to be a vector of potato viruses [*cf. R.A.E.*, A **37** 64, etc.], investigations were begun on its bionomics and control. A breeding stock was maintained on tubers sprouting in moist sand and kept in darkness at high humidity and temperatures of 15–20°C. [59–68°F.]. In feeding tests, colonies were established in a cellar on the aerial parts, usually the leaves, or the underground parts of economic plants of 12 species, a list of which is given. When fruits or underground parts were infested, the Aphids congregated on tender, sappy growth [*cf.* **39** 419], whereas their distribution on leaves was random.

When infested potato tubers were planted in soil, all the Aphids were dead after 21 days, except those on shoots that had been protected by stones from direct contact with the soil. Such conditions might occur in the field, but it is concluded that they would be of only temporary duration and that there is little risk of infestation persisting in this way.

In rearing experiments on potato, alates were rare [*cf.* **39** 419], but somewhat commoner in autumn. Natural mortality was low, though some Aphids were apparently destroyed by *Porcellio scaber* Latr., and colonies of 11, 294 and 1,223 Aphids were built up in 42 days at 6, 14 and 24°C. [42·8, 57·2 and 75·20°F.], respectively, from original batches of three ; the optimum is thought to be about 18–20°C. [64·4–68°F.]. Aphids kept in the dark without food survived for up to 17 days at 6°C. and 100 per cent. relative humidity and for shorter periods in drier atmospheres or at the two higher temperatures. Fumigation of potato tubers for 18 hours with proprietary preparations of benzene hexachloride or E 605 (phosphoric acid esters [*cf.* **40** 45, note]) released from special containers gave unsatisfactory control in the cellar, largely owing to uneven distribution and adsorption on the damp walls and other surfaces.

FABER (W.). **Versuche zur Drahtwurmbekämpfung durch Saatgutbeizung mit Hexamitteln.** [Experiments on Wireworm Control by Seed Treatment with Benzene Hexachloride.]—*Pflanzenschutzberichte* **6** pt. 1–2 pp. 17–26, 1 graph, 8 refs. Vienna, 1951. (With a Summary in English.)

Seed treatment with BHC (benzene hexachloride) was tested near Vienna for its value in protecting summer wheat against wireworms (*Agriotes lineatus* (L.) and *A. obscurus* (L.)). In greenhouse experiments, the seed was mixed with a dry mercurial dressing containing 20 per cent. γ BHC at a rate giving 0·04 per cent. by weight of γ BHC, or soaked for ten minutes in 0·5 or 1 per cent. dilutions of an emulsion concentrate containing 15 per cent. γ BHC, during which time it absorbed nearly 0·01 and 0·02 per cent., respectively, of its weight of γ BHC. The seed was sown in boxes of soil into which numerous wireworms were introduced, and the results were estimated after a month. It was then found that the average percentages of plants damaged were 31·5, 21 and 19·8 for the three treatments, respectively, as compared with 90·7 in the controls, and the average percentages of dead wireworms were about 50 for the first and third treatments, and considerably lower for the second. Germination was somewhat stimulated by the second treatment and unaffected by the others. About 80 per cent. of the damage by wireworms was caused at the time of germination. The dry treatment was also tested in the field, treated seed being sown in late March in soil containing some 9–30 wireworms per sq. yard. There was little reduction in the wireworm population due to treatment, but the stand was significantly improved and the yield increased by 20 per cent. as compared with plants from seed treated with Agrosan. The yields from the BHC plots equalled those obtained on soil free from wireworms.

HERRSTRÖM (G.). **Sambandet mellan blygrå rapsvivelns ålder och känslighet för hexachlorhaltiga preparat.** [The Connection between the Age of *Ceuthorrhynchus assimilis* and its Susceptibility to Preparations containing Benzene Hexachloride.]—*Växtskyddsnotiser* 1951 no. 2–3 pp. 17–26. Stockholm, 1951.

Experience in Sweden has shown that dusts of BHC (benzene hexachloride) give variable mortality of adults of *Ceuthorrhynchus assimilis* (Payk.) on rape, depending on the season, and in tests in 1948, the percentages of dead and affected weevils following treatment were about 30 in May and early June,

when winter rape is flowering and setting pods, 63·5 in the second half of June and the first three weeks of July, when spring rape is flowering and setting pods, and 11·3 in late July and early August, at the end of the vegetation period. Laboratory tests in 1949 and 1950, the results of which are given in tables, showed that this was due to changes in susceptibility to BHC with the age of the weevils, young adults of either sex being highly resistant and only old ones susceptible. Females with well developed eggs were fairly resistant to dusts at the normal rate of application, but showed higher mortality when the rate was increased. It is concluded that dusting with BHC would prove effective in practice only during a period of about three weeks in late June and early July, but applications during this period are recommended since they would indirectly reduce oviposition by second-generation females of *Dasyneura brassicae* (Winn.) [*cf. R.A.E.*, A **40** 54].

MATHLEIN (R.). **Svartbruna mjölbaggen och dess bekämpande.** [*Aphanotus destructor* and its Control.]—*Växtskyddsnotiser* 1951 no. 2–3 pp. 37–38. Stockholm, 1951.

Aphanotus (*Tribolium*) *destructor* (Uytt.) has spread considerably in Sweden [*cf. R.A.E.*, A **31** 438], and numerous cases have been reported in recent years of infestation of mill and bakery products, including packaged foodstuffs, by it. DDT is the insecticide mostly used for control in infested premises, but has proved unreliable, especially against the larvae. Unlike other insects, many larvae and adults of *A. destructor* that are affected by it ultimately recover and resume normal activity. In a test, methoxy-DDT (methoxychlor) appeared less variable and more rapid in effect, a 5 per cent. dust killing or paralysing 100 and 65–90 per cent. of the adults and larvae, respectively, in exposures ranging from two hours to 14 days, as compared with 80–100 and 20–90 per cent. for 5 per cent. DDT. Furthermore, methoxy-DDT is less dangerous to warm-blooded animals.

WAHLIN (B.). **Skidgallmyggan på spridning norrut.** [The Spread of *Dasyneura brassicae* to the North.]—*Växtskyddsnotiser* 1951 no. 2–3 pp. 44–45. Stockholm, 1951.

Infestation of rape in Sweden by *Dasyneura brassicae* (Winn.) was formerly restricted to the south of that country [*cf. R.A.E.*, A **40** 54], but observations in 1951 showed that the Cecidomyiid has now spread to the more northerly area, light infestations being found on rape as far north as Norrköping.

ANDERSSON (I.) & OSSIANNILSSON (F.). **Försök med Pestox 3 som betningsmedel.** [Experiments with Pestox 3 as a Seed Treatment.]—*Växtskyddsnotiser* 1951 no. 5–6 pp. 84–88, 1 fig. Stockholm, 1951.

In experiments in Sweden in 1951, the seeds of various plants were soaked for 24 hours in solutions of schradan [bisdimethylaminophosphonous anhydride] and then allowed to germinate on damp filter paper. The highest concentration that was harmless to growth in each case was selected for field tests and compared with one lower one and no treatment. In the tests with Aphids, the plants were artificially infested and covered with cages. The results of the field experiments showed that the treatments did not protect crucifer seedlings against flea-beetles (*Phyllotreta* spp.) or *Myzus persicae* (Sulz.), oats against the frit fly [*Oscinella frit* (L.)], beans or beet against *M. persicae* or clover against *Macrosiphum* (*Acyrthosiphon*) *pisum* (Harris), but 0·05 and 0·1 per cent. solutions of schradan gave almost complete control of *M. pisum* on peas and *Myzus persicae* on broad beans infested about a month after sowing, with no difference between the two concentrations.

WAHLIN (B.). **Några parasitangrepp på oljedådra.** [A few Parasites attacking *Camelina sativa*.]—*Växtskyddsnotiser* 1951 no. 5–6 pp. 90–93. Stockholm, 1951.

Camelina sativa is being cultivated in Sweden for the production of vegetable oil. It is apparently not much attacked by pests, and in 1951, which was the first year of commercial planting, the only insects found infesting it were *Meligethes aeneus* (F.), *Ceuthorrhynchus quadridens* (Panz.) and flea-beetles. Damage was in no case serious.

LEMCHE (H.). **Forurening af maelkeflasker ved fluer.** [Contamination of Milk Bottles by Flies.]—*Nord. hyg. Tidskr.* **30** repr. 30 pp., 6 figs. Lund, 1949. (With a Summary in English.)

The puparia of various flies are sometimes found in milk bottles in Denmark. Investigations showed that the species concerned are *Drosophila funebris* (F.), *D. buscki* Coq. and *Megaselia* (*Aphiochaeta*) *rufipes* (Mg.). The first appeared to be restricted to Copenhagen, but the other two also occurred in provincial towns. All the known stages and certain diagnostic characters of these flies are described. The adults are attracted to the opened bottles, and the puparia are formed on the sides. When they dry out, they are difficult to remove. In experiments, buttermilk was attractive to adults of *D. funebris* while it was fresh but lost its attractiveness after a week. Cream and normal milk were most attractive when a few days old. The normal washing process adopted in dairies was found to remove the puparia from the bottles before they had dried out, but not after.

Statens Skadedyrlaboratorium. Årsberetning 1949–1950. [Government Pest Infestation Laboratory (Stored Products and Household Pests). Annual Report 1949–50.]—41 pp., 10 figs. Springforbi, 1951. (With Summaries in English.)

In addition to information noticed elsewhere [*R.A.E.*, B **40** 115], this second report from Denmark [*cf.* A **38** 459] contains a description of the Laboratory and a brief review of the main types of insect infestation investigated during 1949–50. *Calandra granaria* (L.) was a serious pest of stored grain in many localities. *Aphanotus* (*Tribolium*) *destructor* (Uytt.) which was first found in Denmark in 1943, was reported once. It is not known in that country outside Copenhagen and does not appear to be spreading so rapidly as in Sweden, where it has become a pest of some importance [*cf.* **40** A217]. Damage to wooden furniture and in some cases rafters by *Anobium punctatum* (Deg.) (*striatum* Ol.) was reported from several places, including the Faroe Is., where infestation was serious.

[SHUMANOV (E.A.).] **Шуманов (Е. А.). The Cicada,** *Cicadetta montana* **Scop., as a Forest Pest.** [*In Russian.*]—*Dokl. Akad. Nauk SSSR* (N.S.) **72** no. 6 pp. 1127–1130, 2 figs., 5 refs. Moscow, 1950.

The Cicadid, *Cicadetta montana* (Scop.), was observed causing considerable damage to deciduous trees, notably lime [*Tilia*], in a forest in the Province of Voronezh in 1949. The nymphs feed on the roots and cause little injury, though they render the trees susceptible to attack by other pests, and the main damage is due to the ovipositing females, which make incisions on thin twigs and branches, causing them to dry up and frequently to break. Many trees 60 years old were killed by the attack, and over half the branches had withered

on others. For control, branches in which eggs have been deposited should be cut off and burned. The adults are attacked by birds, and the nymphs by moles, which might be liberated in areas in which they do not occur.

[Shaposhnikov (G. Kh.).] **Шапошников (Г. Х.). Migration in the Apple Gall Aphid.** [*In Russian.*]—*Dokl. Akad. Nauk SSSR* (N.S.) **72** no. 6 pp. 1183–1185, 9 refs. Moscow, 1950.

Anuraphis (*Yezabura*) *devecta* (Wlk.), of which the author treats *A.* (*Dentatus*) *communis* (Mordv.) as a synonym [*cf. R.A.E.*, A **36** 66], causes the leaves of apple to become galled in spring. Many authors have stated that it does not migrate to a summer food-plant, and the complete annual cycle has been shown to take place on apple in Holland [*loc. cit.*] and England [**29** 283]. Börner indicated in 1932, however, that in Germany, the winged progeny of the fundatrices that develop on apple in spring migrate to umbelliferous plants (*Anthriscus* and *Chaerophyllum bulbosum*) [*cf.* also **36** 66], but produced no evidence.

In 1947, apple trees in Moscow were heavily infested by *A. devecta*. Fundatrices and apterous and a few alate parthenogenetic forms were present on 9th and 19th June, and forms intermediate between alatae and apterae on the latter date. The bisexual generation predominated on 27th June, indicating that the whole cycle is completed on apple in Moscow. Observations in 1948 showed the reverse to be the case in North Caucasus, migration from apple being completed by early June and only the empty galls remaining. Aphids in no respect differing from those on apple were found on *Anthriscus nemorosa* in June and July and on *Chaerophyllum bulbosum* in June. Migration also apparently occurred, though possibly only facultatively, near Leningrad, the Aphids occurring on *A. sylvestris* in July 1947, but not in late May 1948 or late September 1947, and fundatrices and alate migrants being present on apple in June 1948 and gynoparae in August 1949. Migration also occurred in the Crimea in 1949. Apple shoots infested by alate migrants there were caged in May, and on 20th, when the migrants had settled on the muslin top, the cage was placed over plants of *A. nemorosa* and *C. nodosum*. The migrants settled on the root collars and to some extent on the leaf sheaths of *A. nemorosa* and began to reproduce on 22nd, giving rise to apterae. *Chaerophyllum* was not infested. On apple trees, the fundatrices were not mature on 29th April but began to reproduce in early May, most of their progeny being alate, though a few forms intermediate between alatae and apterae were observed. Almost all the galls were empty by late May. *Anthriscus* was not infested in late April or early May, but small colonies of alatae and their progeny, with a few adult apterae, were common on the stems and leaves near the collar in late May. Other observations showed that migration occurred in some further districts in the Soviet Union and not in others.

Two explanations are possible. One is that two closely related, morphologically almost indistinguishable forms are involved, one of which migrates to Umbelliferae while the other does not or does so only facultatively. Some support for this view was afforded by the greater length of the cornicles in proportion to the length of the body in the migrating Aphids from the Crimea and North Caucasus than in the non-migrating Aphids from Moscow, but such measurements are known to be subject to variation. It is considered more likely that one form with differing behaviour is concerned. If this is so, the Aphid migrates fully in the second generation of the year in the Crimea, North Caucasus (and probably Transcaucasia), the Lower Volga and Germany, and probably in a subsequent generation in Leningrad, Kharkov and the Don basin, whereas it does not migrate or does so only facultatively in England and Holland

and in Moscow and some other parts of central Russia (possibly including Voronezh). The tendency to migration diminishes from south to north, though local and temporary exceptions may occur.

The significance of this for control is pointed out. In the south, where migration occurs, destruction of the summer food-plants is advisable, while in the north, where it does not, adhesives should be used on apple to trap the ovipositing females crawling on the trunks and larger branches in July and against the newly hatched fundatrices in early spring.

[Strogaya (G. M.).] **Строгая (Г. М.). The morpho-physiological Condition of *Eurygaster integriceps* during the active Period of its Life.** [*In Russian.*] —*Dokl. Akad. Nauk SSSR* (N.S.) **73** no. 1 pp. 217–219, 5 refs. Moscow, 1950.

In view of the importance of the physiological condition of adults of *Eurygaster integriceps* Put. for their survival during winter and subsequent reproduction, examples taken in grain fields in the Province of Krasnodar (North Caucasus) between late June and the end of July and hibernating adults taken in early August were examined by the methods of Fedotov [*R.A.E.*, A **35** 345]. Adults of the overwintered generation examined in June, when few were still alive, showed almost complete exhaustion of the fat-body and scent glands and little body-fluid. The digestive system was still active, and the bugs had evidently fed on the green parts of the plants. Of the females, most contained a few eggs, some had completed oviposition and a few had been castrated by the larvae of Phasiine Tachinids [*cf.* **33** 301–302]. The scarcity of females having completed oviposition was due to the rapid death of such individuals. Young adults of the new generation showed fair development of the fat-body, much body-fluid, undeveloped ovaries and the presence of starch in the fore-gut. When the bugs were examined later, during the period of preparation for hibernation, they were found to have a more developed fat-body, less fluid in the body cavity and swollen scent glands. Those examined shortly before the flight contained large fat reserves and ample starch in the fore-gut, and the state of their internal organs indicated that high winter survival was probable. Most of the hibernating bugs examined had a large compact fat-body, the fore-gut was filled with starch and the ovaries were in a good condition, but undeveloped. No parasitism by Phasiines was observed.

[Kozhanchikov (I. V.).] **Кожанчиков (И. В.) The Conditions under which the Cabbage Moth (*Barathra brassicae* L.) feeds on new Plants.** [*In Russian.*]—*Dokl. Akad. Nauk SSSR* (N.S.) **73** no. 2 pp. 385–387, 2 graphs, 5 refs. Moscow, 1950.

The ability of insects to feed on plants on which they have not previously been recorded is of importance in the cultivation of new crops, the introduction of known crops into new areas and the establishment of forest shelter belts. Since shelter belts are being used in the Soviet Union, laboratory experiments were carried out in 1948–49 on the ability of larvae of the cabbage moth, *Mamestra* (*Barathra*) *brassicae* (L.), which is widely distributed in Europe and Western Asia, to develop on various trees, shrubs and other plants. Batches of newly hatched larvae were kept on the leaves in darkness at 20°C. [68°F.], and records were made of the duration of development, the percentage mortality and the weight of the pupae. The results showed that the larvae were able to feed on plants belonging to over 30 families, including some on which they have not been observed in nature. Mortality was high on many,

however, and of 26 species of plants, the results for which are shown in a table, the pupal stage was reached on only nine. These included elder (*Sambucus racemosa*), willow (*Salix caprea*), *Prunus padus* and larch (*Larix decidua* (*europaea*)). Only young tender leaves were attacked, and damage would be most likely to occur, if at all, in the south, where the moth emerges early in spring.

[Berim (N. G.) & Édel'man (N. M.).] **Берим (Н. Г.) и Эдельман (Н. М.). Ways of overcoming the physiological Resistance of Insects to Dichlorodiphenyltrichloroethane (DDT) and Hexachlorocyclohexane (BHC).** [*In Russian.*]—*Dokl. Akad. Nauk SSSR* (N.S.) **73** no. 2 pp. 425–428, 2 refs. Moscow, 1950.

In the laboratory experiments described, adults of *Opatrum sabulosum* (L.), which are resistant to DDT and BHC (benzene hexachloride), and larvae of *Blaps lethifera* Marsh., which are susceptible to DDT, were used as the test insects. They were confined for 1–5 hours on surfaces treated with 5 per cent. dusts and then removed to cages, and records were made of the changes that occurred in their physiological condition.

In the case of *Blaps*, against which only DDT was tested, a disturbance in metabolism became evident 1·5 hours after the removal of the larvae from the treated surface. The intensity of respiration increased sharply, its coefficient fell and the weight of the larvae and their water content were considerably decreased, but there was no appreciable change in the content of fats and albuminous nitrogen. All died in 24–48 hours.

The adults of *Opatrum* were little affected by single treatments with DDT or BHC. An increase in the intensity of metabolism and a reduction in weight occurred only during the first five days, after which they all gradually recovered. Since they appeared to be weakest after five days it was thought that a second treatment then might prove more effective. DDT did not, however, produce any considerable changes in metabolism, though it caused up to 7 per cent. loss of water and an increase in the intensity of respiration, but the loss of fats and glucose was insignificant, the coefficient of respiration was unaltered, and mortality did not exceed 14 per cent. after five days. A second contact with BHC proved more effective, however. There was a considerable loss of water, fats and glucose, a reduction of up to 22 per cent. in weight, and a drop in the coefficient of respiration, and the percentage mortality reached 12 after two days and 25 after five. A mixture of 2·5 per cent. each of DDT and BHC was then tested and caused 20 per cent. loss in weight, an increase in the intensity of respiration and a decrease in its coefficient, and mortality reached 16 per cent. in five days. The survivors were given a second treatment, and this caused 25, 37 and 50 per cent. mortality in a further one, two and five days, respectively. The results with this mixed dust indicated a synergistic effect.

[Kozhanchikov (I. V.).] **Кожанчиков (И. В.). Peculiarities of the Hibernation and Diapause of the Gipsy Moth (*Ocneria dispar* L.).** [*In Russian.*]—*Dokl. Akad. Nauk SSSR* (N.S.) **73** no. 3 pp. 605–607, 2 graphs, 4 refs. Moscow, 1950.

The eggs of *Lymantria* (*Ocneria*) *dispar* (L.) undergo part of their development in autumn and overwinter in a state of diapause, development being completed in the following spring [*cf. R.A.E.*, A **30** 233]. In the Province of Leningrad, they enter diapause in September and hatch at the end of April. Winter mortality does not exceed 5–10 per cent. if the eggs are protected from rain in autumn, and temperatures between −35 and −45°C. [−31 and −49°F.] have no observably harmful effect. Development is also possible in the absence of low

winter temperatures, but mortality is then high, as was shown in an experiment in which eggs in diapause were kept at temperatures ranging from 13·3 to 25°C. [55·9–77°F.]. The durations of subsequent embryonic development decreased from 152 to 91 days, but the percentage mortality rose from 11·7 to 95, and the period over which the eggs hatched from 10 days to almost 8 months. In further tests, eggs in diapause were kept for 1–14 months beginning in October or 0·5–10 months beginning in January at temperatures between 2 and −2°C. [35·6–28·4°F.], after which they were transferred to 20°C. [68°F.] for hatching. The periods required for the completion of embryonic development decreased from an average of 88·6 days to 4 (in the only survivor) for the October exposures and from 27·4 to 8 (also in one survivor) for the January ones, and the periods over which hatching occurred also decreased. Mortality fell to a minimum of less than 10 per cent. in the first lot for exposures of about 8 months and then rose rapidly, whereas in the second, it remained at nearly 20 per cent. for exposures of up to about 4 months and then rose steadily to a high level.

It is concluded from these observations that the eggs of *L. dispar* cannot overwinter more than once, and that survival is possible under many different climatic conditions, though not in the tropics.

DÜZGÜNEŞ (Z.). **Türkiye'de turunçgil akarları.** [*Citrus* Mites in Turkey.]—*Bull. Plant Prot.* no. 1 pp. 6–11, 6 refs. Ankara, 1952. (With a Summary in English.)

The mites that are of economic importance on *Citrus* in Turkey are *Aceria sheldoni* (Ewing), *Phyllocoptruta oleivora* (Ashm.) and *Paratetranychus citri* (McG.). Notes are given on their local distribution, and their bionomics and control are reviewed, largely from the literature.

BALÂMİR (S.). **Türkiye'de Fas çekirgesi** (*Dociostaurus maroccanus*) **durumu (1939–1951).** [The Status of *D. maroccanus* in Turkey in 1939–51.]—*Bull. Plant Prot.* no. 1 pp. 11–15, 28, 1 map. Ankara, 1952. (With a Summary in English.)

Records are given of the localities in European and Asiatic Turkey in which *Dociostaurus maroccanus* (Thnb.) was observed in 1939–51, classified as breeding centres, secondary reservation centres and localities from which occasional examples are reported. Their distribution is shown on a map. Most of them are in the western half of the country.

SEÇKİN (R.). **Amasya'da** *Carpocapsa pomonella* **biyolojisinin tetkiki.** [A Study of the Biology of *Cydia pomonella* in Amasya.]—*Bull. Plant Prot.* no. 1 pp. 29–42, 6 figs. Ankara, 1952.

Cydia (*Carpocapsa*) *pomonella* (L.), all stages of which are described, causes serious injury to apple, pear, quince and walnut in the district of Amasya, in north-central Turkey, where 50 per cent. of the apple crop is sometimes infested. Investigations on its bionomics on apple in 1951 showed that there are three generations a year, the adults being present in May-June, June-July, and August, respectively. Records of oviposition in cages and the duration of the various stages are given. If conditions are normal, control should be begun 10–14 days after the adults are first observed, and sprays of DDT are recommended.

HAMMOND (G. H.). **Residual Values of certain Insecticides against Adults and Larvae of *Phyllophaga* spp. (a Progress Report).**—*Sci. Agric.* **32** no. 3 pp. 143–149, 3 refs. Ottawa, 1952.

In experiments in Ontario in 1949 on the control of *Lachnosterna* (*Phyllophaga*) spp. by means of insecticides applied to the soil, BHC (benzene hexachloride) proved to be the most effective material against both larvae and adults, chlordan was somewhat less effective, and toxaphene and parathion were of value only at high rates of application and under favourable field conditions. In 1950, DDT, dieldrin [1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4,5,8-diendomethanonaphthalene], aldrin [1,2,3,4,10,10-hexachloro-1,4,4a,5,-8,8a-hexahydro-1,4,5,8-diendomethanonaphthalene] and chlordan were compared with BHC in an area in which the adults present were predominantly *L.* (*P.*) *fusca* (Froel.). Applications were made before significant flights of adults. Sprays containing lindane [at least 99 per cent. γ BHC], dieldrin, aldrin or chlordan as wettable powders were applied to experimental plots at a rate of 4 lb. toxic ingredient per acre on 25th May. Dead beetles were collected on nine subsequent dates up to 24th June. None of the materials appeared to decrease in toxicity over this period, and the numbers of dead beetles collected per sq. ft. from plots treated with the four insecticides averaged 4·09, 0·54, 1·36 and 0·85, respectively.

In a test against both adults and first-year larvae, sprays containing DDT, lindane, aldrin and dieldrin as wettable powders and dieldrin, aldrin and chlordan as emulsion concentrates, and dusts containing 3 per cent. γ BHC with or without the addition of finely divided sulphur and 5 per cent. chlordan with fine sulphur were applied once at rates of 1·25–20 lb. toxic ingredient per acre on 15th–23rd May. Dead beetles were collected on four occasions ending on 27th June, and a single count of the living larvae in soil from each plot was made between mid-July and mid-September. The best results were given by the various BHC treatments, which killed the greatest numbers of adults and almost eliminated first-year larvae at 5–20 lb. per acre. The addition of sulphur improved the dust. Chlordan was as effective against the larvae, but ineffective against the adults. DDT and the dieldrin emulsion were the only other materials to give significant mortality of adults, and these also reduced the numbers of larvae. The effects of the other treatments varied. The reductions in larval populations were due not only to adult mortality, but also to the direct effects of the insecticides in the soil [*cf. R.A.E.*, A **38** 188]. It is considered that surface applications of BHC to permanent turf at relatively low rates should be effective in protecting the foliage of trees and in preventing damage by the larvae to plant roots. DDT, chlordan, aldrin and dieldrin may be used at higher rates where it is necessary to avoid risk of crop tainting, but further tests are needed with dieldrin and aldrin to determine whether they are sufficiently persistent to kill the larvae at the feeding levels.

BAYNE (A.). **Some Notes on the Defoliation of Larch.**—*Quart. J. For.* **43** no. 2 pp. 74–77. London, 1949.

BAYNE (A.) & CHRYSTAL (R. N.). **The Clay Weevil (*Otiorrhynchus picipes* F.) an occasional Pest of young coniferous Plantations.**—*Op. cit.* **45** no. 3 pp. 169–171, 4 refs. 1951.

In the first of these papers, the author records damage to young Japanese larch [*Larix kaempferi*] in Derbyshire by adults of a weevil thought to be *Hylobius abietis* L. but stated in the second paper to be *Otiorrhynchus singularis* (L.) (*picipes* (F.)). The larches were planted in 1946–48, intermixed with some Scots pine [*Pinus sylvestris*] and a few beeches, and the damage consisted of

stripping of the foliage of the leading and side shoots, with some injury to the bark. The severed needles were strewn round the bases of the plants. *P. sylvestris* suffered little or no damage.

In the second paper, the literature on the habits of *O. singularis* is reviewed, and characters are given distinguishing it from *Hylobius*. In 1949, the spring attack began in late April, and by early July the numbers of weevils were much reduced. Newly emerged adults were found in the soil under oak stumps in a neighbouring larch plantation. There was apparently one generation in the year, the eggs being deposited in the soil under the oak stumps in June and the adults overwintering in the pupal cells until the following March or April. It is concluded that in the absence of sufficient oak on which to feed, *O. singularis* attacks recently planted conifers, the choice depending on the succulence of the plants and the softness of the bark. The range of age over which the trees are susceptible is probably small.

AITKENHEAD (P.). **The Gladiolus Thrips—a Pest new to Britain.**—*Agriculture* **57** no. 11 pp. 517–523, 1 pl., 1 map, 17 refs. London, 1951.

Taeniothrips simplex (Morison) was first observed on *Gladiolus* in Holland in 1949 and in England in July 1950, when it was found to be common in north-eastern Middlesex. Infestations were found in many other localities throughout England and in Scotland and Wales in the same year, but few appeared to have been spread by breeding before 1950. It is evident that thrips infestation can become serious in average summers, but the ability of the insects to survive under varying conditions of growing and storage in Britain is not known. It probably cannot live out of doors in winter and must depend on corm infestation for its survival from year to year.

The symptoms caused on *Gladiolus* by *T. simplex* are described, and its life-history, food-plants and control in summer and winter are reviewed from the literature. In Middlesex, a spray of 5 oz. 20 per cent. DDT wettable powder and 0·5 pint summer oil in 6 gals. water failed to save a flower crop or prevent infestation of the corms when applied ten times between the end of July and mid-September, and applications of an emulsified solution of DDT failed at Bristol, but both attempts were begun too late in the year. The wettable powder left a deposit on the leaves and flowers, but had no phytotoxic effect.

PAPERS NOTICED BY TITLE ONLY.

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